Making TV Sound: A History of Television Sound Operation from 1970-2010

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Abstract

This thesis investigates the the changing practices, technologies, and cultures of sound operators working in Britain's television industry from 1970 - 2010. Television production in Britain changed fundamentally throughout this period as a result of industrial reorganisation and significant technological change. During this time, operational sound personnel have experienced significant disruption to the practices, cultures, and communities that make up their daily working lives.

Focussing particular attention on the reorganisation of the 1980s and 1990s, this research contributes an understanding of, how these industrial, technological, and cultural shifts took form within the work of television sound personnel and how this group has adapted and reorganised as a result. This thesis aims to show that the working lives and experiences of television sound operators are now significantly different from those employed before this period of industrial and technological transformation. It will be argued that not only are technologies and working practices of sound operation now considerably different, but so too are the ways in which members of this community interpret and portray their work, identity, and skills. In order to achieve this the experiences of this group of professionals shall be discussed through analysis of topics such as training, innovation, working practices, production hierarchies, and professional identity.

At a time when television sound is frequently being criticised by the press and wider public, this thesis aims to explore the practices and cultures of a group of professionals whose work remains under researched and misunderstood by many.

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Contents

Introduction

This thesis is concerned with the changing practices, technologies, and cultures of sound operators working in Britain's television industry during a time of fundamental change. The main aim of this research is to analyse the effects of industrial and technological reform on the individuals specifically employed to record, edit, and mix the soundtrack of British television. In doing so, this thesis intends to show that the working lives and experiences of television sound operators are now significantly different from those employed before this period of industrial and technological transformation. It will be argued that not only are technologies and working practices of sound operation now considerably different, but so too are the ways in which members of this community interpret and portray their work, identity, and skills.

The television industry in Britain has seen substantial and far reaching reform throughout the latter decades of the twentieth century. Beginning in the 1980s, this industry has reorganised and fragmented under the pressures of government policy and wider economic remodelling. As with many industries throughout this period, television has moved, almost universally, away from vertically integrated institutions to become reliant on the commissioning and outsourcing of numerous processes. Utilising this new model, broadcasters have distanced themselves from production and now rely on a substantial supply of smaller companies to produce and supply programmes. For those working in production, the employment environment is now fundamentally different. Traditionally, working in television production consisted of full time, and often life long, employment within a vertically integrated broadcaster, such as the BBC and ITV franchises. These institutions not only provided their employees with security, but also supplied a clear career path, a recognised management structure, and an entrenched set of practices and working cultures. However, as broadcasters have transitioned to become primarily commissioners of productions, they have disbanded their significant production workforces. As a result, the employment landscape is now characterised by freelance project based work governed by casual networks and personal reputation. In contrast to the fixed stream of work within vertically integrated broadcasters, careers are now

made up of fragmented and irregular projects with no guarantee of repeat employment. For those working in production, insecurity and competition are now inherent aspects of working life.

Coinciding with the reorganisation of industry, the development of new production equipment has resulted in digital technologies being adopted wholesale into the tools of television production. For those working in technical roles, the affordances, design, and ubiquity of such technologies have acted to intensify the effects of structural reorganisation in an increasingly cost conscious and hierarchical industry. Digital technologies provide a host of new affordances and allow for practices that would not have been viable, or even achievable, using analogue equipment. Furthermore, the user friendly nature of such technology allows for effective operation with fewer resources and at a considerably reduced cost. As a result, it is now commonplace for an individual operator to complete work that would have traditionally required a small team of skilled operators. In an industry that is now more competitive than ever, producers have often viewed digital technologies as a means to cut costs, rather than extend professional practices.

As a result of these shifts, the experiences of individuals working in television production are now fundamentally different from those of personnel employed within a vertically integrated broadcaster. However, analysis of how these changes have affected those working in below-the-line positions, such as sound operators, camera operators, and lighting technicians, remain few and far between. With regards to sound operators, there is currently no detailed analysis of how this specific production community has been effected by, and has reacted to, this period of significant disruption.

At the industrial level, the changing landscape of British television has been well documented by academics and popular writers alike. Numerous works (Tunstall, 1993; Ursell, 2000b; Born, 2004; Seaton, 2015) offer comprehensive accounts of events such as the launch of Channel 4, deregulation, and the weakening of trade unions. However, more precisely fo-

cused analysis of the personnel within this industry, particularly those in technical roles, has been less forthcoming.

In recent years, production studies researchers (Caldwell, 2008; Banks, Mayer, & Caldwell; 2009; Mayer, 2011) focussed primarily on the US film and television industries, have made considerable progress in studying the below the line communities at the heart of film and television production. As a result of this work, we now know far more about the cultures, communities, and identities of production workers, as well as the practices and technologies utilised in their day to day work.

However, within this growing collection of work, the industrial and geographical limitations of such analysis are clearly evident. The experiences of production communities are not felt uniformly across industrial and geographical boundaries. As such, the objective of this thesis is to add to the existing body of production studies research by analysing the experiences of sound operators within the specific and unique context of Britain's television industry from 1970 to 2010. This work shall analyse the effects of industrial and technological reform and investigate the ways this community has reacted to a working environment that has changed radically over this forty year period. This research focuses on five broad aspects of sound operators' working lives. These are: training, innovation, use of technology, interactions with wider production personnel, and the culture and identity of sound operation. This thesis contends that these aspects of working life are now significantly different and present considerable new challenges for those seeking to make a living in television sound.

While this thesis was being researched, the sound track of television in Britain has caused some highly publicised controversy. As shall be discussed, numerous programmes have attracted considerable criticism for incidents of inaudible dialogue. However, the resulting debate and analysis has seemed significantly lacking in any understanding of the people, and processes, that construct television's soundtrack. While scholars of film sound have made considerable progress in incorporating practice into the wider discourse (Altman, 1985; Kerins, 2011; Beck, 2016), research into television sound lags considerably behind in this regard. As studies of film sound have shown, such an understanding is integral to enabling a

more comprehensive and fruitful analysis. Therefore, this research aims to develop an understanding of the practices and communities of sound operation, from which a more extensive and informed analysis of the television soundtrack can be made.

Defining the Sound Operator

Throughout this thesis, the term sound operator is an important and frequently used phrase. Within the following chapters 'sound operator' functions as a convenient catchall phrase with which to describe all those employed in sound related activities within television production. Sound operator was not a specified job title encountered at all during the research process. However, it is a term that the majority of interviewees would identify with when discussing their work, much like other broad colloquial labels assigned to various complex professions such as 'scientist' or 'lawyer'. As such, it is an appropriate and succinct term for dis-cussing and analysing many industry wide and job specific trends, such as the shifts in training provisions, which have affected all those working in sound related roles. Within the wider profession of 'sound operation', there are of course multiple individual job roles and communities who possess their own practices, skills, identities, and cultures. The interviewees for this research represent a broad cross section of these dis-tinct job roles and communities. The most common of these are Location Sound Recordist, OB Sound Super-visor, and Post Production Dubbing mixer as well as the range of assistant roles that support these senior operators. The practices of these roles are undoubtedly varied, and there are numerous subtleties that separate the skills and requirements necessary to work in each role. For example, a defining factor of OB sound operation was the liveness of the event being covered and the team effort required to stage a successful OB. This would undoubtedly be alien to the work of a post production dubbing mixer who works in relative isolation and with the ability to commence, pause, and restart their work at any point. Furthermore, for a location sound recordist, the ability to be self sufficient and operate with minimal equipment was of paramount importance, something clearly not shared with their colleagues in OBs or post production who relied upon significant technological infrastructure in order to complete their work, either in the form of the OB truck or the dubbing suite. The details of these roles, and how they differ from

one another will be discussed in chapter 2, however, it is important to note that, despite these differences, the fundamental principles, skills, and challenges within this work remained consistent throughout this range of job roles. The vast majority received identical training, were employed by the same organisation, and shared the same guiding objectives when conducting their work. Almost all interviewees identified themselves as technicians who utilised, and often battled against, complex technologies, and who, as part of a wider production team, worked to achieve

the best possible programme, both technically and artistically. This shared identity and the understanding of their role as servicing the fundament objective of creating high quality television programmes is undoubtedly binds these job roles together more significantly than the subtleties of their practices distinguish between them. As such, it is undoubtedly possible to draw clear, firm, and accurate conclusions across these range of 'sound operators' despite the subtle, or sometimes significant, differences from one job role to another. Therefore, in the coming chapters 'sound operator' will be utilised when discussing this group as a whole and any issues discussed whilst using this label can be seen as equally significant amongst the range of job roles within this community.

Thesis Outline

Chapter 1 offers a detailed review of the existing literature pertinent to this research and the methodology and methods by which this investigation was conducted. Initially, it explores sound scholars' growing engagement with practice in film sound analysis and the evident industrial and geographical influences of research. Following this, attention shall turn to the growing field of production studies literature in an effort to indicate how this thesis fits with existing studies of below the line communities. Subsequently, the industrial reshaping of Britain's television industry shall be outlined in detail in an effort to provide the structural context within which future analysis is presented. Finally, this chapter draws on the work of historians of technology to explore the socially constructed nature of innovation and the import-

ance of the ‘technological framework’ to this process. This particular strand of literature is particularly relevant to Chapter 4 but is also an important theoretical foundation on which all the following chapters are based.

Chapter 2 offers an account of the standard working arrangements, practices, and technologies of sound operation within vertically integrated broadcasters. Analysis shall assess not only the technologies and practices of this era but also the culture of this working environment and the priorities of those working within it. This chapter aims to identify the personnel at the heart of this research and provide a context within which future chapters should be analysed. Chapter 3 then investigates how changes to training have affected the skills, knowledge, and experience of new sound operators entering the industry. As a result of industry wide reorganisation, the provision of training has shifted from being the responsibility of vertically integrated broadcasters to being provided by external universities. This chapter shows that, as a result of this new training environment, sound personnel are provided with a considerably different set of skills and knowledge when embarking upon their careers. Furthermore, as training has become separated from industry, and fragmented by the large number of new providers, below the line operators no longer enter the industry with a shared ethos and common understanding.

Chapter 4 assesses the role of sound operator in the development of new technologies and the changes to this role as a result of industrial reform and technological developments. As the chapter will argue, in the era of vertically integrated broadcasters, operators had considerable input into the development of new equipment both directly and indirectly through the influence their significantly resourced employers. However, broadcasters have, in light of reorganisation, significantly reduced their research and development activities and disbanded their cohort of staffed sound operators. As a result, those in operational roles have lost their collective representation within the development process and seen their perceived input into innovation significantly reduced.

Building on the analysis of training and innovation, Chapter 5 tackles the changing practices of sound operators in relation to the skills and knowledge utilised within daily working activities. This shall be discussed specifically with regards to technical knowledge and operator 'tinkering'. Tinkering, defined here as technical skills and knowledge utilised in order to maintain, fix and modify equipment, was once fundamental to the successful completion of sound operators' work. However, this chapter argues that these skills have ceased to feature in day to day practice as digital 'black box' technologies have proliferated and the training of sound operators has been reformed. As a result of this, these skills no longer retain the esteem and social value that was attributed to them in the era of vertical integration and no longer play a pivotal role in the professional identity of sound operators.

Chapter 6 offers analysis of the role of sound operators within the wider production hierarchy. As will be shown, the technologies of television sound have become significantly less labour intensive and increasingly user friendly. This, in conjunction with the ever more cost conscious production environment, with its reliance on unstable freelance labour, has resulted in the work of sound operators being marginalised within the production hierarchy. This chapter will argue that increasing anxieties surrounding future employment and mounting financial pressures have resulted in sound operators feeling less able to raise legitimate concerns regarding their practice. The risk of being labelled as awkward, and potentially being dropped from the informal network that governs future work, is now seen by operators as outweighing the benefits of asserting themselves with those who occupy a productions positions of power. Furthermore, the lack of a shared governing employer, and recognised management structure, has further stripped sound operators of their ability to exert influence over their colleagues, particularly those in above the line roles.

The final chapter of this thesis analyses the changing ways in which sound operators view their work and project their professional identity. As sound operators have come to terms with new training provisions, the ubiquity of digital technologies, and their new place within the production hierarchy, they have experienced a shift in the value attributed to the skills they possess. This chapter argues that sound operators have shifted the value of their

work, and the basis of their professional identity, away from skills based on engineering and technical knowledge towards skills centred on creativity and artistry. Within these roles creativity is now stressed as the most prominent and coveted component of the work of sound operators. This new professional identity undoubtedly fulfils a utilitarian purpose of cultivating value in an increasingly inhospitable and unstable working environment. However, sound operators have experienced a genuine extension to their professional practice and do indeed experience creativity in an exclusivist sense. As shall be shown, creativity is now inextricably linked to job satisfaction and therefore should not be seen entirely as a method of increasing their productive capacity within the reformed production economy.

Literature Review

> Audio terms remain virtually unknown. The type and placement of microphones, methods of recording, mixing practices and loudspeaker varieties and many other fundamental considerations are the province of a few specialists...Perhaps the most important single requirement for a revival of interest in the soundtrack is an increased sensitivity to problems of sound technology (Altman, 1985, 44-45).

In his 1985 essay 'The Evolution of Sound Technology', Rick Altman argued that in order to reinvigorate academic engagement with film sound scholars needed to turn their attention to the developments in sound technology and the working practices of the personnel who actually make film sound. Altman was critical of sound scholar's obsession with firsts and, subsequently, the disproportionate amount of academic work devoted to the invention of sound recording technologies and their integration into filmmaking. Fortunately, in recent years some progress has been made by a number of scholars towards a better understanding of the technologies and practices used by sound operators in Hollywood film production. Simultaneously, production studies writers have shed significant light on the working practices, identities, and arrangements of those who have historically been "woefully absent in the otherwise diverse range of research on television" (Mayer, 2011, 2). However, television studies, particularly research focused on British television, is yet to see any significant engagement with the technologies, practices, and cultures of the medium's sound personnel of the type advocated by Altman and a growing number of scholars. In recent decades, the British television industry has undergone radical, and well documented, industrial, structural, and technological change. As a result, the way television personnel form, and work within the mediated societies of production has altered significantly. However, the experience of sound operators throughout this period, as well as their ever-changing practices, tools, identities, and cultures are yet to form part of the research on Britain's television industry. This chapter reviews a wide range of literature to illustrate how this study complements existing work in both sound studies and production studies and how it hopes to contribute to these established fields.

This chapter will start by reviewing existing works on sound in film and television, going on to look at the growing wealth of writing within the field of industry and production

studies, before outlining the changing industrial context of Britain's television industry. Finally, it shall look at current literature on technological development, particularly social histories of technology, which will be of particular relevance to Chapter 4.

Sound in Film and Television

The vast majority of work on television sound has focused on the form, and role, of sound in television content and the communicative process. The first major academic writings on television sound can be traced back to Altman's essay *Television/Sound* (1986), which developed and built upon theories first put forward by Ellis in his book *Visible Fictions* (1982). As a medium of domestic consumption, television was limited by both the quality of small screen monaural television sets and the manner in which consumers interacted with and viewed television. John Ellis (1982) wrote that television encouraged a glance method of viewership, in contrast to the gaze of the cinema viewer (Ellis, 1982, 50). Glance viewing has a profound effect on television's reliance on, and effective utilization of, sound. As television does not require total concentration and is often not the sole activity of the viewer in the domestic setting, television content utilizes sound to tether viewers to the programme and "to drag viewers back to looking at the set...for TV, sound has a more centrally defining role" (Ellis, 1982, 129).

Rick Altman built upon the idea of television's reliance on sound by introducing the notion of 'household flow' to Raymond Williams' theory of televisual flow (Williams, 1975). Altman argued that, whilst a useful theory, flow is not an inherent characteristic of television as a technological medium, but rather the application of television in certain cultural and industrial environments by particular social groups. Altman stated that the level of flow directly correlates to the industrial practice of "the commodification of the spectator in a capitalist, free enterprise system" (Altman in Modelski, 1986, 41). This in turn impacts on the form of sound used in television content. Altman wrote that broadcasters and producers in the US constructed methods of using sound in order to keep television sets on whilst 'viewers' com-

plete other tasks in the home. The ratings system of the A.C Nielsen company, which at the time did not differentiate between televisions that were simply on and televisions to which active attention was being paid, meant that sound became "charged with mediating the relationship between the two flows" (Altman, 1986, 40). Altman listed a number of functions of the television soundtrack, including "italicizing" moments of importance, "labelling", and the generation of "internal audiences" such as occurs with sports commentary. However, Altman stopped short of assessing the influence of these functions on both the working practices of television sound operators and the technologies made available to them.

The notion of the elevated status of sound over image within television content can also be found in the writing of later theorists. In his book *Audio-Vision* (1994), Michel Chion argued that television is not evenly reliant on the combination of images and sound to communicate its narrative content. Unlike cinema, which is defined by the image, television is far more reliant on sound and, thus, takes the form of "illustrated radio":

> Television is illustrated radio. The point here is that sound, mainly the sound of speech, is always foremost in television. Never off screen, sound is always there, in its place, and does not need the image to be identified (Chion, 1994, 157).

This view that, historically, sound led television content that was deficient in image quality is also found in the work of Herbert Zettl, who, in his 1990 book *Sight, Sound, Motion*, argued that the difference in the nature and quality of sound in television compared to cinema is due to a "matching of energy" to the related image (Zettl, 1990, 352). In television, this means that sound is supplementary to "low definition' images", communicating information that cannot be narrated through these poor quality images alone, a technique on which film does not need to rely due to its use of "exciting visual sequences" (Zettl, 1990, 337). During such sequences, sound - particularly dialogue and narration - can take a back seat to image without losing "story flow or energy". However, if these same scenes are replayed on

television, the "energy loss" undergone by the images leaves the same soundtrack feeling "spotty and uneven" (Zettl, 1990, 337).

This line of argument resurfaced as recently as 2012, when James Batcho built upon these arguments by stating that television (particularly news programming) has been influenced by both cinema sound and, significantly, radio. Batcho showed that, while narration is used intermittently in film, it has come to dominate television. When discussing American news programming, Batcho argued that television takes cinema's intelligibility model and couples it with radio's direct address communicative style. This incorporation of style means that speech takes total priority within the soundtrack, leaving television open to domination by authoritative voices:

> Through cinema sound practice, television had its audio-visual model of continuity and vocal clarity; through radio, television found interiority and structure. The same goal is at work for both industries: production practice dictates a preservation of the voice at the expense of all other naturally occurring sound elements in order to preserve the perceived legitimacy of the broadcaster (Batcho, 2012, 1005).

What is clear from the above described writing on television sound is the consistent and established theorisation on the role and form of sound in television. The utilisation of sound within television has historically been optimised for television's domestic viewership and gives priority to speech and narration, even beyond the normal prioritisation of intelligibility as found in film. However, so far, few accounts remain of the practices by which this is achieved, or the communities of skilled workers that facilitate it.

In his book *Documentary: Witness and Self-Revelation*, John Ellis has assessed some of the specific standard technologies and practices historically used by sound recordists working in documentary production. While the book is not specifically limited to television, the significant crossover in practice, and the abundance of documentary programming on British tele-

vision, means that it does give a useful initial insight into the work of television sound operators. Discussing the sound recording technologies of the early 60s, Ellis states:

> Sound recording onto quarter inch became tape quickly became standard. Swiss-based company, Nagra, was developing a tape recorder that could be used in the field […] the Nagra III in 1958, a solid state machine (i.e. not using fragile valves) which ran a 7-inch reel of sound tape (Ellis, 2012, 38).

In addition to discussing the specific technologies of the era, Ellis has touched on how these technologies affected standard practices for documentary production crews. Significantly, Ellis discussed how, despite the affordances of these new technologies, the working requirements of the documentary crew often shaped practice rather than the capabilities of individual technologies, due to the "many routine tasks that had to be carried out to support each of these machines and their operators" (Ellis, 2012, 39).

Ellis continued to focus more specifically on the requirements of the sound operators, showing that the new affordances of transistorised ¼ inch tape recorders were often negated by a lack of corresponding capability in other technologies, particularly microphones.

> Microphones presented significant problems. There were no radio microphones that could be clipped to an individual's lapel with a small transistor hidden in their clothing...Instead, documentary filming needed microphones suspended on a boom or 'fish pole'. It was very difficult for a sound recordist to operate a fish pole in addition to carrying the Nagra and monitoring the sound levels it was picking up. So a boom operator was normally required (Ellis, 2012, 39).

Ellis' work highlights a number of technologies and practices in documentary production, as

well as the concerns of sound operators working in the field. It also illustrates the complex and intertwined relationship between technology and practice. While individual technological affordances may allow for certain methods of operation, in the complex environment of production, they are often overridden by wider technological, practical, and industrial concerns.

With regard to assessments of the work of sound operators, their technologies, and working cultures, the film industry, in the US, has been better served by academic research than that of television. Numerous scholars have touched on both the industrial and technological factors that have shaped the working practices of film sound operators; however, the majority of these studies have assessed sound operation only in relation to the qualities of the film soundtrack. As such, there is little discussion of the cultures, identities and social codes of the individuals and communities conducting this work. In the same collection of writing in which Altman appealed for further engagement with working practices, Mary Anne Doane (1985) argued that film sound production processes were developed to be as imperceptible to the viewer as possible. Doane put forward that the bringing together of sound and vision posits two potentially competing communication ideologies in direct opposition. The soundtrack may not, and cannot, project similar or harmonious information to that of the image at all times. Therefore, to negate this potential contradiction, the work of sound operators becomes an exercise in perpetuating specified relationships between the sound and the image, which obscures the specificities of the soundtrack, as Doane stated:

> Symptomatic of the repression of the material heterogeneity of the sound film are the practices which ensure effacement of the work involved in the construction of the soundtrack (Doane, 1985, 57).

Significantly, Doane went on to specify a number of such practices and how they are implemented by film sound professionals, pointing to blooping as one significant practice that obscures the materiality of the soundtrack by covering over splices in the magnetic film stock. This practice "results in a fast fade in, fade out effect [...] the effect desired is that of smoothing over a potential break, guaranteeing flow" (Doane, 1985, 57).

Doane went on to mention the practice of staggering sound cuts to draw attention away from the jump in visuals. She also mentioned the practices and technologies of location sound recording, showing that, the need to fit with the image necessitated technologies and practices that allowed a greater symmetry between image and sound:

> Western Electric moving-coil microphones and RCA velocity microphones were made available to the industry, simplifying boom construction. The action on the set was more easily followed and the maintenance of sound perspective ensured. The presentation of all sound as being emitted from one place could not be sustained (Doane, 1985, 60).

John Belton (1985) completed this trio of technology and practice-based articles featured in *Film Sound; Theory and Practice*, in which he made another early assessment of the technologies of film sound production. Belton argued that, while images can portray objective reality, it is the role of sound to construct and apply a secondary representation defined in visual terms. It is from this function that the practices of film sound acquisition and editing immerged. Belton states:

> What the sound track seeks to duplicate is the sound of an image, not that of the world. The evolution of sound technology and that of studio, editing, and mixing practice illustrate, to some degree, the quest for a soundtrack that captures an idealized reality (Belton, 1985, 67).

Belton went on to discuss more specifically some of the technologies and practices with which this was achieved, singling out directional dynamic microphones, radio mics, and the technique of location mixing as particularly important to this task:

> Condenser microphones, which tend to 'go noisy' in wet weather, are supplanted by quieter dynamic microphones. By 1939, unidirectional microphones are designed, achieving a 10:1 ratio of desired to undesired sound...The soundman, in effect, duplicates through sound the space seen on the screen: the microphone mimics the angle and distance of the camera, creating a sound that matches the visual perspective (Belton, 1985, 68).

On radio mics, Belton went on to state:

> Radio microphones pick up speech before it is projected - that is, before it can acquire spatial properties. Though it can be given some perspective during the mixing process, the quality of the sound differs from that recorded by traditional microphones hung just beyond the camera's field of view. Though it permits more freedom in shooting and ensures good sound coverage, recording with radio microphones lends a surface quality to the image (Belton, 1985, 69).

At the time, Belton's work was undoubtedly a welcome addition to field engagement with technologies and practices, particularly in regard to radio mics. However, with regard to its approach to technology, Belton's work now seems lacking in necessary specificity, in which he discusses technologies, such as condenser microphones, without exploring their multiple separate and distinct technologies, which have an array of different applications and features. Furthermore, there remains little examination of the communities of skilled workers that developed and perpetuated these practices, an aspect which requires further investigation beyond their relationship to the qualities of the finished soundtrack.

In later years, writers on film sound began to discuss in more detail the industrial and cultural factors that influenced the development of sound production in film. Discussing the

initial introduction of sound into film, Altman showed that the dominance of intelligibility within film soundtracks was made possible by the migration of labour from radio into film:

> For where has Hollywood found its sound technicians? By far the majority…had come from the radio studios. The early years of sound cinema were thus heavily marked by the version of reality offered by other modes of representation. (Altman, 1992, 55).

James Lastra (1992; 2000) also supported this notion, stating that, whilst intelligibility had become the dominant method of utilising sound in cinema, it was not the only strategy available. His work identified two emergent philosophies of sound utilisation in cinema at the time when sound cinema was gaining traction over silent cinema. Lastra identified these as the "fidelity model", which aims to maintain spatial-temporality, and the "telephone model", which aims to capture intelligibility above all else. Lastra continued:

> Within classical Hollywood style there exist types of sound representations that correspond to both the telephonic and fidelity modes. (Lastra, 1992, 76).

In his later work Lastra (2000) showed that the intelligibility model became dominant due to the sound operator's reflexive ability to change their practices to fit with the wider production hierarchy and working arrangements. Lastra continued to show that, although early film sound operators favoured a fidelity-centered approach to their work, this approach slowed the integration of sound operators into production crews. It was only through significant training and adaptation to an intelligibility-centered approach that sound operators, and thus sound itself, came to be fully embraced within film production.

Jay Beck (2003) further discussed the implications of technological and industrial change for film sound operators at a time when their industry had been through its own period

of significant reorganisation. Beck showed how the affordances of technologies, such as solid state recorders, acted to drive experimentation and new practices among sound operators in film production. However, Beck also clearly showed that new technologies, particularly in changing industrial settings, can be utilised to enforce new limitations and achieve the goals of those in a more elevated position in the production hierarchy. The conflict between new expanded practices and increased streamlining and downsizing due to technological affordance and industrial imperative is clear through much of Beck's work. His 2003 paper argued that, during a time of significant upheaval, the Hollywood film industry saw new solid state ¼ tape recorders as one way of reducing labour requirements and, therefore, costs, discussing the technical possibilities of the Nagra III and the advances it made on existing technologies:

> Stefan Kudelski Nagra III tape recorder changed many attitudes towards ¼" tape [...] the sound mixer and boom operator effectively could do the entire job of a four-man sound crew and do it more efficiently. In a pinch a single operator alone could [operate] (Beck, 2003, 232).

Beck described how it did not take long for producers to react to these technological affordances as a means of enforcing their aims and objectives with the subsequent working arrangements, and associated labor negotiations, leaving sound personnel in a "state of crisis".

> The need for both additional technical staff and operators was drastically reduced through the course of the 1960s. The producer's union actively pushed for renegotiating Local 695 contracts to provide a saving in labor costs...This would involve…the redeployment of employees to new jobs...As a result, the sound industry, like many other industries reliant on the rapidly declining studio system, entered into a period of crisis (Beck, 2003, 232).

However, in his later book *Designing Sound* (2016), which focussed more on the aesthetics of sound than sound operators' specific labour arrangements, Beck has discussed the creative and experimental potential unlocked by these technologies. Discussing the influence of documentary practice, and technology, on film sound, Beck stated:

> The main aesthetic effect of lightweight recorders such as the Nagra III was the liberation of sound from the constraints of the image. No longer was the sound team literally tied to the camera on location. Instead sound recordists were free to experiment with microphone movements, recorder location, and a general separation of sound from the image (Beck, 2016, 30).

Beck also touched on the conflict between innovation and cost efficiencies in regard to post-production technologies, describing how the use of new technological affordances to extend sound operator practice is often thwarted by the use of new technologies by those in senior positions for more financially driven aims. He argued that the concept of a self-identified sound designer, a single individual with control over the sound mix, only became feasible as a result of the "loosening labour structure[...] and the decline of the studio system created space for such "sound auteurs" (Beck, 2003). However, his later work argued that, in actual fact, the true "sound designers" of a film's soundtrack are those with financial control and influence over the implementation of particular technologies, further pointing to the influence of senior personnel over below-the-line[1] staff when it comes to technological affordance:

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[1] "The line" is a commonly used industry term used to separate two significant labour categories in film production. Mayer (2011) identifies above–the-line personnel as those "who manage themselves and use their intellectual capacities", while identifying below-the-line workers as "tradespeople, artisans and others who used their manual skill under the control of managers" (Mayer, 2011, 4). This research utilises such terms in accordance with Mayer's definition and, as such, sound personnel are identified as firmly 'below the line'.

> The true designers of sound are either those who are able to dictate what technology will be used or those who adapt the existing technology to suit their particular aesthetic needs...In the case of such individuals, the choice of technology generally preceded any serious thought about its aesthetic application (Beck 2008, 75).

Mark Kerins (2011) also addressed, with greater specificity, the changing landscape of post-production sound in US film, and by extension the working practices of its operators, in his work on Dolby Surround Sound. Much like Beck, he has pointed to the reflexivity of new technologies as a means to achieve the goal of a given social group. While the affordances of new post-production tools provide sound operators with greater choice and flexibility, these are once again frustrated by the requirements of those at the top of the production hierarchy:

> While audio post-production technologies have improved, sound designers, editors, and mixers have simultaneously been asked to do more with them...This increased workload tends to counterbalance any time savings from technological improvements (Kerins, 2011, 152).

Rather than new technologies, combined with loosened labour structures, offering more control to any one sound designer, Kerins argued that that new technologies, combined with squeezed timeframes and reduced resources, have resulted in sound editors and mixers actually losing their grip on creative control. He described how, in an effort to complete a project by the deadline, post-production houses will often employ, on short contracts, a great number of people to work on a film soundtrack. This influence of such a large number of people leads to a loss of creative control and an inability to deliver creative work:

> This problem is addressed simply by hiring more sound editors...Throwing bodies at a sound track generates enough 'person hours' to get all the 'necessary' sound edited into the movie, but at the expense of creativity. Maintaining any sense of consistency when thirty or forty people are frantically cutting effects necessitates placing fairly severe limitations on each editor's creative freedom (Kerins, 2011, 151).

Wider industrial changes and producers using new technologies to cut schedules and budgets, rather than as tools for creativity and experimentation, have meant that sound editors and mixers have seen their working environment reshaped and characterised by overwork, squeezed deadlines, and a loss of creative control.

What Beck and Kerins have made clear is that industrial and technological developments have had a significant effect on the sound operators' day-to-day work in the US film industry. However, the effects of these changes are neither fixed nor predetermined, depending significantly on the actions and objectives of differing social groups within the film production environment and offering a wealth of new affordances and opportunities for experimentation and new practices. For those funding production, they also offer the opportunity to reduce the amount of time and resources dedicated to sound. As sound operators are clearly not the dominant social group within this hierarchy, they must adapt to working within this new environment imposed upon them. While Beck's and Kerins' work go a considerable way to shedding light on the practices of sound operators within US film production, there still remains a lack of critical engagement with their communities and identities. Although both authors allude to changes within these communities, such as the rise of the "sound designer", they do not show much direct engagement with this aspect. Nonetheless, there is clearly much to be gained from both authors' work, which provides a clear precedent for this kind of research on British television production.

The importance of geographically specific research can be seen in the work of Katie Quanz (2015) and her study of sound post-production in the Canadian film industry. In her

article *Pro Tools, Playback, and the Value of Postproduction Sound Labor In Canada*, Quanz engaged with the shift in sound operators' identities and communities due to technological and industrial change. Quanz focused on the new working practices and working environment of post-production sound in Canada brought about by the industry-wide acceptance of Pro Tools. Pro Tools was able to enter the Canadian post-production market due to its low initial cost, high functionality, and compatibility with Avid picture editing software. Quanz shows how this new affordable technology opened up the post-production market to many who would have been priced out of the industry in earlier years by the high price of analogue equipment and its associated costs. Inevitably, this led to a flood of new post-production houses and freelance workers all competing for work in a relatively limited Canadian film market which had failed in its goal to attract work away from established film strongholds in the USA (Quanz, 2015).

Like Beck and Kerins, Quanz has highlighted the Pro Tools system's facility for much faster and simpler working practices, leading not only to much shorter deadlines but also to a reduction in the staff required to complete a project. This, in conjunction with an oversaturated market and a slump in film production, led to large scale redundancies, the casualization of labor for post-production sound, and a spike in competition for paid work:

> Facilities began to lay off [staff]. Sound editors and re-recording engineers who had been receiving a steady salary were now only being paid for each day that they were called in to work on a project [...] they now had to compete for work with their former colleagues and assistants (Quanz, 2015, 43).

Quanz argued that, in response to the threat posed by new post-production technologies to job security and availability, those working in post-production sound began to redefine their professional identity. Those working in sound post production used trade publications to alter the way their work was viewed by the wider industry, shifting the perception of them from technicians doing a technical job to artists doing a creative job. Quanz argues that this

was a clear and concerted effort to solidify their identity as an important profession in the production hierarchy:

> The shift to publicizing talent over technology started once the majority of facilities had adopted Pro Tools...The trade paper's revaluation of the role of sound editors and mixers in the industry suggests that there was a concerted effort to shift the conception of sound practitioners from technicians to artisans in order to preserve their threatened place within the industry (Quanz, 2015, 45).

Quanz's work is a clear example of the reflexive nature of below-the-line communities and showcases their ability to adapt and construct new identities when faced with technological and industrial upheaval. Quanz also clearly illustrated the importance of geographically and industrially specific research of this kind. The introduction of Pro Tools itself did not necessitate such a drastic change to the employment of post-production sound professionals in Canada, nor did it necessitate the need for them to to redefine their professional identity. However, in combination with the overzealous attempts of the Canadian post- production industry to present itself as an alternative to the US industry, the use of Pro Tools led to a saturated, and significantly more competitive, market for those working in post-production sound.

Wider Production Studies

In the growing field of production studies, researchers often fall short of analysing the material practices of production, a trend even more pronounced with regard to the practices of sound operators. However, this research is successful in addressing the communities, rituals, and self-perpetuated identities of those working in below the–line-production roles, particularly in times of change, uncertainty, and threat.

Technological and industrial developments feature heavily in production studies literature due to how they facilitate changes in practice, working environment, and, subsequently, working communities. As John Caldwell has stated:

> The ways that technologies on set are used to establish, cultivate and reinforce cultural ideas about the function and agency of the crew members there...The work task, worker status, worker interrelationships and cultural significance of work all change depending on how production technologies are used and why (Caldwell, 2008, 153).

For a number of scholars, the "new cultural ideas" related to below-the-line staff and new technologies are often centered around notions of deprofessionalisation, the loss of creative control, and significant damage to worker status. Caldwell himself has provided numerous examples of new technological affordances changing the cultural ideas that surround production work. This is most strikingly apparent in his assessment of the rise of "digital sweatshops" in the post production industry in Los Angeles (Caldwell, 2008, 160). Caldwell argued that due to the multifunctional nature of digital editing software, combined with risk-minimising outsourcing strategies that use so-called "digital boutiques", the environment in which post-production editors now work resembles a sweatshop. These "digital sweatshops" are characterised by extended working hours, increased workloads and the expectation of multitasking:

> Post production workstations today allow and encourage users to cross all sorts of previously sacred and well-guarded trade boundaries [...]Technical breakthroughs in editing today, like FCP [Final Cut Pro], tempt smaller production companies to dispense with the higher cost of 'real editors (Caldwell, 2008, 165).

Caldwell showed that nonlinear editing processes break down traditional working patterns and, moreover, that the ease of use and flexible nature of their software mean that they threaten jobs in their entirety. In a later publication, Caldwell argued that these developments in user friendly post-production tools, in combination with the rise of boutique "sweatshop" post-production houses, has led to the rise of "backdoor workforces". These workforces comprise young university graduates fighting for low paid entry level positions who inevitably draw work away from more established, and expensive, industry personnel (Caldwell, 2010). Referring specifically to the "cultural ideas" surrounding this type of work, Caldwell stated that they remove control from the editor and add considerable stress to their work activities. Furthermore, these technologies strip editors of their status as skilled workers, as the focus of work shifts from constructing a high quality edit to simply utilising the features of the technology:

> Producers in middle and low budget productions create pressure on their workers to use and incorporate the bells and whistles [that digital editing programmes make available] even if they lie outside the worker's specialisation. As in any sector, multitasking stresses workers and undercuts control and focuses fine tuning (Caldwell, 2010, 225-226).

John Ellis also touched on how changing practices, due to technological affordance, changed the approach, culture, and language of the edit suite. Traditionally, 16mm documentary film editing was characterised by highly skilled workers whose decisions were thoughtfully considered. Due to the characteristics of the medium, decisions made in the edit suite were generally final. Discussing these processes, Ellis stated:

> The culture of the film documentary cutting room was craft-oriented and collaborative within a firm hierarchy...Detailed judgements and execution were the work of the skilled editor...Decisions could be taken relatively slowly and iteratively (Ellis, 2012, 79).

However, the development of computer-based digital editing interfaces has, according to Ellis, had profound effects on the practice and ethos of editing. The simplification of the edit process means that budgets have been cut and schedules severely reduced. More significantly, however, the tradition and craft-oriented culture of the edit suite and the elevated status of the editor have been eroded, with power shifting to those higher up in the production hierarchy. As Ellis described:

> The simplicity of the physical process meant that traditional skills could be employed more fully [...] Much of creative potential of digital editing was swallowed by the shrinking working time allocated by producers [...] Much of the creative dialogue of the old film cutting room disappeared... 'Digital work flows'...had to be designed to rein in creativity and experiment in television (Ellis, 2012, 83).

Besides Caldwell and Ellis, a number of scholars have pointed to broadcast journalism as an area of television in which the introduction of new production technologies has changed the status, tasks, and relationships of below–the-line workers. While perhaps not falling strictly within the discipline of production studies, Simon Cottle and Mark Ashton's 1999 article, *From BBC Newsroom to BBC News Centre*, detailed how developments in electronic news gathering (ENG) technologies were seen by management as a tool for costcutting through the promotion of multi-skilling, non-specialisation and the flattening of career progression, stating:

> Technology, like the cavalry to the rescue, is pictured as a means by which financial equilibrium can be restored...in relation to jobs, three fundamental changes have taken place; redundancy/redeployment, re-designation and of course multiskilling (Cottle and Ashton, 1999, 29-32).

This point has been echoed by Casey, Calvert, French and Lewis (2008), who also highlighted how this change in practice has happened specifically within the BBC:

> Given increased media convergence, many workers are expected to be multi-skilled [...] This has been aided by the emergence of cheaper and more intuitive digital technologies that allow for one person to undertake, with relative ease, the roles of four or five (Casey, Calvert, French and Lewis, 2008, 221).

Cottle and Ashton went on to note the effect of this shift on the professional identity of those working in technical roles, noting that, in this new environment, journalists' self-identification as creative is diminished, quoting one contributing interviewee:

> We don't have the time to be creative. It's not that the equipment will not let us be more creative, it's physically we don't have the time to be as creative as we used to be (Cottle and Ashton, 1999, 41).

More generally, the ubiquity of multi-skilling as a result of new technological affordances and its effect on professional status have been noted by Mark Deuze (2007), who has argued that, while technological affordance alone is not the catalyst for industrial change, it is frequently used to reinforce such change. Often the implementation of new technologies does

not mean the complete eradication of skilled work, but rather the displacement of traditionally skilled workers into jobs of reduced prestige and skill, such as data wrangling and logging:

> New information and communication technologies reinforce the tendency for actors and other film industry workers to be freelance rather than salaried and for the de-professionalization of their jobs. As is for example the case of digital cameras replacing film, their capacity for almost endless shooting and recording erodes the position of the people who load, cut and edit celluloid film (Deuze, 2007, 184).

Production studies scholars have also paid considerable attention to how below-the-line workers adapt, consolidate, and communicate their professional identities as a result of new cultural ideas about their jobs and the new working environments in which they are expected to perform. John Caldwell argued that these workers in Los Angeles construct "imagined communities" (Caldwell, 2008, 125-129) in an effort to generate and communicate cultural value in a churning "nomadic labour system" (Caldwell, 2008, 113-119):

> Employee churn has placed a far higher premium on the ability of crafts workers to identify themselves as unique, valuable...Explanations of worker's cultural significance can mean the difference between low-ball jobs and more prestige productions (Caldwell, 2008, 114-126).

There are particular ways for these workers to communicate value and status to others in these communities. Caldwell has pointed to the prominent use of "war stories" and "against all odds" tales as a tool by below-the-line insiders to communicate within these groups and perpetuate status, both within and without the community.

Vicki Mayer's (2011) research on camera operators in the fledgling US softcore porn industry has further illustrated the identities and constructed communities found in television production. Mayer argued that camera operators in this niche industry perpetuated an identity as "professionals", thus distancing themselves from amateurs in order to give value to their work. This allowed them to assume a higher status of legitimacy, thus protecting their labour value from the influx of amateur camera operators into softcore production as it gained popularity in mainstream US television. Mayer continues that camera operators in this field perpetuated this identity also as a way to also give credibility to their jobs in what was seen as a marginalised, even taboo, form of television content. Camera operators first achieved this distinction through the acquisition of pay, which, although only comprising a small monetary amount, had significant symbolic value. Even for those who had achieved this initial distinction, there were further self-imposed and autonomy-based hierarchies within these communities:

> Independence was important to defining a soft-core professional as a craftsman [...] In this sense, professionalism was a way of identifying one's technique, discipline, and dedication in the face of work that was standardized, subservient, and only about wages (Mayer, 2011, 81).

The presence of precisely constructed identities within what may appear single homogenous groups also appears in the work of Emma Sandon (2007). Discussing research conducted at a reunion of ex-BBC staff at Alexandra Palace, Sandon showed the clear divisions between them, even years after their retirement. During the reunion, those who had worked in above-the-line production roles did not mix with those who had performed technical craft-based roles, while those who had worked in management roles did not associate with former administrative staff. Furthermore, women were almost completely excluded from groups other than the all-female group of assistants and secretaries. While distinctions such as these arise from differences in class, education, and gender rather than a concerted effort to create desirable identities and convey value, it is significant to this thesis, particularly Chapter

6, that, even in communities with a significantly shared identity, distinctions, hierarchies and exclusions are both present and meaningful.

As shall be discussed in Chapter 7, those working in television sound, particularly post-production sound, also construct intercommunity distinctions, based on notions of creativity, to build up cultural capital and perpetuate an identity of value. This need to cultivate cultural value is present in production studies research aside from Mayer's, and has been shown not to be limited to those working in technical roles. Ann Gray (2010) argued that documentary producers use phrases such as "instinct" when describing their skills in order to perpetuate a sense of mystery in an industry where "the creative process is a hugely valuable asset" (Gray, 2010, 64). Furthermore, in her work on television documentary producers, Caroline Dover argued that the producers' implication of "documentary craftsmanship" is an "evocative" defence of their craft against commodification and industry constraint (Dover, 2004, 252). Beyond simply accruing value and desirability in isolation, such self-assigned identities are often used to gain leverage over and marginalise other groups of professionals. As Miranda Banks (2009) has described, individuals in other craft-based roles often disparage the work of costume designers, likening their craft to "glorified shoppers" (Banks, 2009, 94). Furthermore, the separation of production roles into distinct and separate communities has altered the more direct day-to-day communication that occurs within the production environment. Beth Bechky described how, in the era of temporary organisations, different members of production staff negotiate this new working structure tentatively through the use of profuse thanking, polite admonishment, and joking in place of frank discussion due to the absence of the defined structures, rules, and codes found in unionised labour (Bechky 2006). As a result of vertical disintegration, communities and individual identities now play a far greater role in the work of below-the-line production staff, with both having a significant effect on the ways in which craft workers go about securing work, accumulating leverage, and even completing mundane daily communication.

As shown above, considerable research has now been conducted, within this growing field of study, on a differing range of production-based roles and communities. However, with

the exception of Quanz (2015), there is no engagement with the communities of highly skilled personnel occupying roles in sound. It is this gap in the research that this thesis aims to fill, thus contributing to the fields of both production studies and sound studies.

The Reorganisation of Britain's Television Industry.

In order to fully address the many issues put forward in the following chapters, it is important to first outline the wider industrial changes that have so dramatically altered the environment in which these individuals work. The failure to properly address influence at a macro level risks the research becoming too narrowly focussed on the micro-assessments of one particular group within the wider context of television production (Lotz, 2009). This first section of this chapter will, thus, briefly review the significant industrial and economic shifts that fundamentally altered the environment of television production.

The 1980s and 90s saw fundamental changes to the landscape of British television that were underpinned by the neo-liberal economic policy championed by the Conservative government. These changes had a profound effect on the working lives of production personnel and, along with technological developments, gave rise to a number of issues discussed in later chapters. From the launch of ITV, in 1955, until the introduction of Channel 4 and its *publisher-broadcaster* model, in 1982, British television remained in a state of "comfortable duopoly" (Ursell 2000a; Born 2004). The BBC was the sole beneficiary of license fee revenues while ITV secured advertisement revenue through its regional monopolies. Both the BBC and the ITV franchises operated as large vertically integrated organisations with direct ownership of, and responsibility for, both production assets and permanent members of staff. The special status enjoyed by the BBC and ITV meant that financial restraints were rarely felt by those in charge of financing production. Jeremy Potter (1989) argued that, at the ITV franchises, "production resources of the industry, studios and staff were being used at no more than an estimated 65-70 per cent of capacity" (Potter, 1989, 25). Jeremy Tunstall (1993) also described the lack of attention paid to efficiency and budgetary constraints, stating that produc-

ers “had little idea of the real cost and often suspected, or knew, that the ITV company itself or the BBC also did not know the real cost” (Tunstall 1993: 9*)*. For production staff, security was an inherent characteristic of their working lives and, although hard to attain initially, a career with a broadcaster was viewed as a ‘job for life’. The considerable bargaining power enjoyed by the unions led to generous pay rates and enhancements, particularly at the ITV regional franchises, whose reliance on advertising revenue made them vulnerable to industrial action (Saundry, 1998; 2001). Gillian Ursell (2000a) showed that, in 1980, both the BBC and regional ITV franchise Tyne Tees spent 60% of their respective operating costs on wages alone.

The launch of Channel 4 in 1982 ushered in a new business model, the publisher-broadcaster, spurring the growth of a “small army of independent production companies” (Ursell, 2000b, 750). Growth within the new independent sector, and its ability to facilitate the publisher-broadcaster model, was seen by the government as fundamental to the reforming of television production. The 1986 report issued by the Peacock committee, which had been tasked with investigating the long-term financing of the BBC, applied further pressure to the traditional producer broadcaster system. The report was highly critical of the rigid structure of vertically integrated broadcasters and the lack of market competition, which it saw as artificially inflating labour costs and providing poor value for licence fee payers. The report put forward numerous recommendations, which were adopted into the 1988 White Paper on broadcasting and would eventually make up the details of the 1990 Broadcasting Act. Most significant amongst these recommendations was the proposal that the BBC and ITV must source at least 40% of all output from independent producers, although this was revised down to 25% in the eventual 1990 act (Saundry, 1998; Ursell 2000b: 752). In addition to compulsory outside commissions, the funding of both organisations saw significant change. ITV franchises would now be awarded on a blind highest-bidder system without any programme quality criteria. This disadvantaged vertically integrated producer-broadcasters who incurred significantly higher fixed costs than their publisher-broadcaster competitors, again heaping pressure on the traditional organisational model for broadcasters. For the BBC, licence fee increases were capped in line with the Retail Price Index (minus 3%), with the long

term future of the fee dependent on the BBC delivering "value for money". This instigated a drive within the BBC to improve efficiency, leading the well-known internal market initiative known as "Producer Choice". Introduced in 1991, Producer Choice separated commissioners and producers from day-to-day production facilities and staff, empowering them to negotiate with both internal and external resources. It aimed to inject market competition into what had traditionally been a closed shop and, in doing so, enabled the BBC to benefit from the efficiency savings the market supposedly provides. In the run-up to the charter renewal of 1996, the BBC was under pressure to show it was providing "value for money", leading to the swift closure of internal facilities that could not compete within this new market (Harris & Wegg-Prosser, 1998; Born, 2004) A further result of this new legislation was that ITV was also stripped of its responsibility for managing Channel 4's advertising. This broke the duopoly that had been in place for 35 years and again increased pressure on both the BBC and ITV to implement efficiency savings (Born 2004: 51). Simultaneously, the 1990 merger of Sky TV with BSB, creating BSkyB, saw significant growth in satellite television distribution, which, with its subscription model, was seen as offering a more direct link between consumer and broadcaster, and therefore offering the consumer more power and influence over content and delivery. Whilst this new connection between broadcaster and consumer is debatable, this development undoubtedly furthered the already mounting pressure on the BBC and ITV by introducing yet more competitors into the once impenetrable television market (Ellis 2002: 62; Stoyanova, 2009; Tunstall 1993: 11).

For those working in technical roles, this pressure meant a consistent barrage of redundancies, pay reductions, and casualisation, as broadcasters transformed themselves from vertically integrated organisations with their own technical staff into latent organisations (Starkey, Barnatt, & Tempest 2000) using informal networks of repeat freelance staff (Storey, Salaman, & Platman 2005: 1040). The role of unions became increasingly diminished as ITV banned national level collective bargaining, opting instead for individual company arrangements. With new franchise winners refusing to recognise the unions' right to collective bargaining, the scope of issues open to collective bargaining was consistently eroded throughout the 1990s (Saundry 1998; 2001). Although less pronounced than at ITV, the role of the

unions was also steadily marginalised at the BBC, as management implemented individual tailored contracts for new employees in place of collectively negotiated terms. With the unions unable to stop changes to these contracts, this resulted in greater flexibility and fewer obligations for the BBC, one example of which being the shift from an hourly rate of pay to day rate pay and the removal of penalty payments for overrunning shifts. However, more significant than the reduced collective bargaining with broadcasters was the large scale disbanding of permanent standing workforces. Gillian Ursell (2000b) stated that, in a ten year period from 1986 to 1996, the BBC got rid of 33% of it's staff, while ITV laid off 44% of their permanent workforce, of which "80% [...] were from production personnel." (Ursell 2000b: 757). Georgina Born complemented these figures, stating that, while, pre-1980, the BBC and ITV had accounted for the vast majority of television jobs, by 1994, freelancer workers made up 54% of all television staff (Born 2004: 180). Mark Deuze has gone further, showing that, according to data from 2005, 71% of those working in film and television were unemployed "at least once a year for periods of ten weeks or more" (Deuze, 2007, 177). Deuze continues:

> Television therefore must be seen as a combination of a growing number of people coming into an industry that is increasingly fragmented and networked (Deuze, 2007, 177-179).

Chapters 3 - 7 of this study look more closely at the specific impacts of these fundamental shifts and the working environment that ensued on numerous aspects of sound operators' work. As the above review has shown, throughout the 1980s and 90s, the television production industry shifted from being characterised by large vertically integrated organisations in a highly protected market to a highly competitive collection of streamlined publisher-broadcasters. For those working in the industry, security and longevity has been replaced by high risk short-term contractual work, based on the reputational networks of freelancers.

Social Histories of Technology

Another strand of literature important to this research is that which details the histories of technological development and innovation. This study is, of course, interested in technological developments in television sound and the impacts that the affordances of these technologies have had on practice. It is also, moreover, interested in the cultures of innovation that have been generated as technological development has shifted from being lead by vertically integrated broadcasters to a network of unconnected manufacturers. In order to analyse such changes, it is important to identify the relevant theories surrounding innovation and address how this research fits within these theoretical frameworks. Pinch and Bijker (1989) described how technological innovation is neither a linear nor simple process. In championing the social construction of technology, they state that innovation is "multidimensional" (Pinch and Bijker, 1989, 29) and that any one particular form of technology is by no means the only possible outcome. The outcomes of technological innovation are influenced by the differing problems facing multiple social groups, each of which require different outcomes in order to address them. Pinch and Bijker criticised the simplistic nomenclature attached to social groups, such as developer and user, and argue that the social groups involved in innovation are often more complex and nuanced than these simple labels suggest. Using the example of the development of the bicycle, they showed that, for a particular social group consisting of young able-bodied men, the bicycle was a tool for sport and therefore speed was of paramount importance. However, for a social group consisting of women, such bikes and their riding style raised both moral and safety concerns, which, in turn, spurred the development of new frame designs and tyre materials. Pinch and Bijker, expanded on this, showing that, through "interpretive flexibility", social groups find different uses and applications for a technology once it has achieved relative stabilisation.

For many social historians of technology, along with the issues raised by Pinch and Bijker, the notions of collaboration and collective resources, often in large institutions such as

the military, are a driving force of technological innovation. Such themes were prominent in the work of Bijker himself (1989), who, following on from his work on the bicycle, put forward the theory of the "technological framework" in his history of bakelite, an early form of plastic. Bijker argued that innovation only becomes possible when approached from within an appropriate technological framework, consisting of an established set of practices and knowledge. These frameworks allow for innovation to be approached, and appropriated, in a way that most effectively serves the social group in question. Shared experience and knowledge helps to attribute meaning to practices and establish a shared "grammar" (Bijker, 1989, 173) between both engineers, manufacturers and, crucially, non-engineer users. Bijker defined a technological framework as:

> A combination of current theories, tacit knowledge, engineering practice (such as design methods and criteria), specialized testing procedures, goals, and handling and using practice (Bijker, 1989, 168).

Using the example of plastics, Bijker showed that the stabilization of Bakelite as an artifact only became possible when the technological framework of those working on it shifted. While early innovators worked within a framework of chemical theory, bakelite only came into being when it became the focus of those working within electrochemical engineering. The theory of the technological framework is present in historical accounts of other technologies written around the time of Bijker's work on bakelite. Although not directly identifying it as a technological framework, Susan Douglas (1989) showed how technological frameworks were implicit in the development of radio in the early twentieth century. Originally the brainchild of lone "inventor heroes", Douglas argued that it was in fact large scale players, such the US Navy and, to a lesser extent, AT&T, who propelled the advancement of radio technology in the US. With huge resources at their disposal, an intake of technologically inclined young officers, and significant interest in the development of radio communications in the period preceding World War I, the US Navy and the corporations they worked with shaped the resources that Bijker posited as constituting a technological framework.

The importance of large scale resources and the power of institutions also feature in the work of Thomas Hughes (1994), who argued that technological innovation, particularly in large technological systems, is spurred by what he called "technological momentum". Hughes placed his theory somewhere between technological determinism and social construction, stating that innovation becomes possible, and is accelerated, once it has gained sufficient momentum from societal needs and the available resources and expertise. He has pointed to the increased congestion experienced on the roads of large cities in the US as providing the momentum for the development of underground and elevated railway systems in New York and Chicago. Furthermore, Hughes pointed to World War I and its implications for the import of nitrogen compounds as the driving force behind the technological momentum that led the US government to develop the Wilson Dam. The US government used its own resources and accumulated knowledge to generate the vast amounts of electricity necessary to manufacture its own compounds. Technological momentum is not only produced by sufficient societal needs. For a societal requirement to become innovation - it also requires a sufficient store of resources, trained personnel and established expertise. Like Hughes, Thomas Misa (1994) pointed more directly to the analytical significance of the intermediate institutions that exist "between the firm and the market" (Misa, 1994, 139) in his work on the development of the US steel industry.

In the field of film studies, Allen and Gomery (1985) also showed the importance of the technological framework to the cultivation of innovation. Although they do not directly use the term technological framework, their work undoubtedly adds to the notion that both a broad range of infrastructure and institutional influence have a fundamental role in spurring innovation. Allen and Gomery were critical of what they call the "great man" theories of individual invention and how such theorising obscures true analysis of technological innovation. They state,

> So long as one holds that the ultimate cause of technological change is the genius of a few individuals, then there is not much else in the way of historical explanation that needs to be said (Allen & Gomery, 1985, 111).

Allen & Gomery went on to describe how, in fact, it is systems of concepts that are at the heart of innovation, rather then lone individuals.

> Usually the invention is not a single idea, but rather a system of concepts linked together. Certainly that is the case for most inventions in motion picture technology (Allen and Gomery, 1985, 114).

The notion of linked systems of innovation, or the technological framework, again appear in the work of Bordwell, Staiger, and Thompson (1985). Discussing the early development of the American studio system, Bordwell and Staiger stated:

> Only institutions could have systematized and guided technological research and development in an industry as complex as the American studio cinema [...] In an important sense, Hollywood's filmmaking only became a modern industry when it joined forces with corporate research (Bordwell, Staiger, and Thompson, 1985, 251)

Significantly for this research, particularly Chapter 4, Kristin Thompson discussed the role of larger companies in enforcing standards in an industry full of small specialized firms. Thompson showed that, rather than being small isolated centres of innovation, early film companies in fact relied significantly on a network of much larger support companies and manufacturing firms. These much larger manufacturers supplied technologies that could be modified for specific uses by these, at the time, small film making companies. Thompson stated that, by fostering good links with film companies and utilising their considerable research resources, these companies could effectively impose standards on the industry:

> Standardisation of equipment tended to occur due to conditions in the film equipment market. [...] The large existing corporation [...] would foster the adoption of similar equipment across the industry. The corporation could dominate the field by size and by utilising its research facilities to create the best product. In a limited market, competition would tend to eliminate all but a few smaller, specialised firms (Bordwell, Staiger, and Thompson, 1985, 263).

Clearly, the technological framework was of fundamental importance to innovation in the Hollywood film industry. Furthermore, as Thompson showed, large firms had the power to push development and standards across the wider industry. Although this occurred in a different context to the role of the BBC outlined in Chapter 4, (the companies to which Thompson referred were interested in maximising profit and acted intentionally to promote industry-wide standards), it clearly shows the agency that large corporations have within industries filled with smaller organisations.

Issues relating to the importance of industry-wide integration of technological innovation can be identified beyond the accounts discussed above. In their later exploration of the components of the Social Shaping of Technology (SST) approach to technological development, Williams and Edge (1996) detailed many aspects common to the multiple studies that fall within the SST approach. Significantly for this research, Williams and Edge also pointed to the importance of the relationship between developers, users, and institutions in successfully implementing technological change. They argue that simply having the economic and technical tools available to design a technology does not guarantee its successful implementation. Technological development rely on "alliances of interests" drawn from those with the relevant interests, expertise, and resources (Williams and Edge, 1996, 10). Furthermore, Williams and Edge made use of Freeman's notion of coupling to show how high levels of collaboration occur between interested parties to share information, spread risk, and increase potential success:

> In emerging product areas, where products and markets are developing rapidly, with high levels of uncertainty, close forms of coupling are likely, including collaborative development. Vertical collaboration between supplier and user allows an exchange of information about technological opportunities and user needs. Horizontal collaboration allows players to share the risks in development (Edge and Williams, 1996, 15).

Clearly, for social historians of technology, collaboration between the different social groups involved is a significant driving force in the innovation process. However, this collaboration is not unguided, instead existing within a framework that organises knowledge, establishes norms, and fosters collaboration. As Bijker showed, while these frameworks are not dependent upon institutions, they often centre on bearers of significant resources and status, which can be seen in Bijker's work on fluorescent lighting as well as research conducted by Douglas (1989), Hughes (1994), and Sterne (2003). While Edge and Williams pointed to the prominence of these bearers in high risk and developing markets, this research will show that vertical and horizontal collaboration were a defining feature in the development of sound technologies in the broadcast television industry despite its significant heritage and resources. At the heart of this were vertically integrated broadcasters, significantly the BBC, which were instrumental in representing multiple social groups, establishing frameworks, and fostering 'coupling' amongst the relevant social groups.

Wider literature in fields such as business and management studies further point to the importance of knowledge accumulation, collaboration, and risk spreading in technological development. The theory of "absorptive capacity" is important to any assessment of innovative broadcaster practice in the era of vertical integration, a theory not dissimilar to Freeman's coupling. It was in 1990 that Cohen and Levinthal first put forward the notion of "absorptive capacity" and the role it plays in a company's ability to conduct efficient research and development in order to produce new and innovative products. Succinctly, "absorptive capacity" refers to a company's ability to identify, assimilate, and apply valuable external knowledge

(Cohen and Levinthal, 1990; Lane, Koka, and Pathak, 2006; Roberts 2015). Absorptive capacity, and a company's ability to use it, is reliant on extensive existing knowledge on both the technical aspects of the subject at hand and experience of the culture, idiosyncrasies, and tacit knowledge at play within the industry in which the company operates. Cohen and Levinthal point to the success of large Japanese electronics companies as examples of vertical integration fostering absorptive capacity.

In the context of broadcast television, an example of such absorptive capacity can be found in the Limin Liang's (2013) study on tapeless production in China which looked at how broadcasters bring end users into equipment design, exploring the development of the Network Production and Broadcasting System by Chinese Central Television (CCTV) in the run-up to the 2008 Olympic Games. At that time, CCTV fostered cooperation between relevant social groups and its technical and creative departments, enabling it to implement fundamental changes to practice (moving from tape-based to tapeless storage and editing) while still incorporating the goals and ambitions of these disparate social groups. These two departments, or social groups, within CCTV clearly had differing sets of problems and needs that this new technological artifact, tapeless storage and editing, would be used to solve. The engineers working in the technical department were focused on the efficiency of these new processes, while the end users in the creative departments, in this case CCTV producers, were keen to exploit the creative potential of the affordances of this new technology.

Liang argued that these producers of sports coverage were able to work with engineers under the technological framework established at CCTV to contribute meaningfully to the development of the network production system. In doing so, they extended the interpretive flexibility of this technology beyond simply finding new or novel patterns of use and utilised it to adapt the technology during development:

> The development of new technology involved the tight coupling between design and use...This lead to successful cases where the creative personnel, with the help of technological development personnel, enacted the "resource" potential of the new technology and created new applications...The agency of users helped reconfigure the material features of the network technology, while the technology people helped users realise their creative goals...The innovation was propelled by both parties sensitivity to the potential of digital technology (Liang, 2013, 478-480).

As shall become clear, there are significant differences between Liang's assessment of the development of the Network Production System at CCTV and the analysis that shall follow in this chapter. CCTV was not a cultivator of absorptive capacity between end users and third party manufacturers, as developments were made in-house under the CCTV umbrella. In this case, both parties were directly employed by the same entity and therefore shared the exact same technological and industrial framework. Furthermore, these negotiations took place between engineering creative staff who occupied above-the-line production roles and related to large technological systems that fundamentally changed the nature of production (from tape-based to tapeless), rather than merely bringing about minor changes to relatively small technological cogs in the production machine (such as sound recorders or mixing desks). However, what is clear is that, by establishing a shared technological framework, maintaining large resource pools, and championing absorptive capacity among the various relevant social groups, CCTV effectively brought about significant innovation in a way that involved users on a fundamental level.

For the development of television sound technologies, and undoubtedly other technologies, broadcasters play an integral part in establishing the technological framework of production tools, as well as fostering absorptive capacity within the industry. Broadcasters provide small scale manufacturers, both directly and indirectly, with a host of resources such as extensive product testing, collaboration with highly trained engineers, and access to large pools of highly trained end users. Significantly, both Bijker and Cohen & Levinthal's theories are not

binary in practice, with Bijker demonstrating varying degrees of inclusion of social groups in technological frameworks. Some groups, such as engineers working directly on a technological artifact, may experience very high levels of inclusion in the innovative process. Others, such as independent users of a technology, will most likely experience a lower level of inclusion in this process. While falling short of recommending an optimum investment level, Cohen and Levinthal argued that active investment must be made in absorptive capacity if a company is to remain competative. While overinvestment may not deliver results any more efficiently, failure to invest can lead to firms being "locked out" of technological trends and, in some cases, exiting the industry.

Technological frameworks often feature prominently in histories of broadcasting technologies. While popular histories of such technologies may favour the lone inventor narrative, many have shown that, only when innovative efforts become organised and incorporated into a wider framework, do they lead to the stabilisation of new technologies. Jonathan Sterne (2003) has showed that, although Bell and Edison are generally thought of as lone inventors, their innovative processes reflected wider shifts in the status of innovation and technological development in the US. Sterne argues that innovation shifted from "an artisanal to an industrial mode of production[...] what was invention in the 1870s became research and development by the 1920s" (Sterne, 2003, 186). Susan Douglas also showed that those involved in the development of radio underwent a similar shift to organisation and professionalisation, arguing that, through shared educational experiences and institutional affiliations, those involved in radio engineering in the US distinguished themselves from "mere amateurs and tinkerers" (Douglas, 1989, 30). Prior to the period covered in this research, television had, of course, already established itself as a significant industry inhabited by professional personnel, as described by Sterne and Douglas. Histories of early British television, such as those by Aldridge (2012) and Briggs (1965; 1979; 1995), have discussed this shift from lone inventor to technological framework in detail. While early developers, such as John Logie Baird and EMI, proved the technical possibility of the transmitted image, it was the BBC, with its large engineering resources and experience of radio broadcasting, that turned television into a coherent and desirable form of broadcasting.

A further important theory regarding technological innovation within organisations, and one that has already been mentioned in passing in this review, is that of "interpretive flexibility". As has been shown in sound-specific studies by Belton (1992), Sedman (2012), and Lyons (2013), technological development only becomes innovation once it transitions from novelty to norm and finds both fixed form and a set of uses. This process, known as interpretive flexibility, has been discussed by numerous historians of technology, including Susan Douglas (2006). Much like Bijker's discussion of social groups, Douglas has argued that technology can be interpreted in numerous ways, depending on the milieu in which it is found and the social group using it. Douglas argues that the dominant social group determines whether technology is utilised restrictively, despite the affordances it may provide. Douglas labels this the "irony of technology", citing the example of American television production, which, armed with new technologies and production potential, has "turned within" and become dominated by cheap reality television rather than more outward looking content. Wanda Orlikowski (1992) also noted this phenomenon, describing what she calls the duality of technology. Orlikowski has stated that technological development is shaped by human interaction and interpretation both during and after the period in which innovation becomes fixed or "has crossed the line of implementation". However, not all actors have the same agency with which to interpret technologies and their affordances. In an industry which is highly hierarchical, the interpretive flexibility exerted by the dominant social group can have significant implications for groups with less able to exert their interpretative preferences. As discussed in the preceding review of production studies and sound studies literature (Beck, 2003; Caldwell, 2008; Deuze, 2007; Kerins, 2011; Quanz 2015), the dominant groups in film and television production have interpreted digital technologies in a way that has reduced the time and resources dedicated to craft processes, enforced new employment structures, and often stripped below-the-line staff of their position as skilled craftspeople. Clearly, any history of sound technology in television production must take into account the role of interpretative flexibility in shaping new working practices and environments.

Developments in the wider television industry have fragmented and casualised the workforce while simultaneously reducing investment in the development of production technologies. In this new working environment, end users now experience a lower level of inclusion in innovation processes and are less instilled in the technological framework of their industry. In addition, the grammar of these processes is now less firmly established and harder to navigate as the industry has seen significant upheaval. Furthermore, the shifting structure of the television industry has placed considerably more influence in the hands of above-the-line staff and limited the ability of below-the-line staff to shape their practices in light of new technological affordances. As a result, technologies are frequently interpreted and put to use by productions so as to serve those above-the-line staff that control budgets and resources.

Methodology

The aim of this research is twofold. Firstly, it is interested in uncovering the developments in the technologies and practices of television sound operators throughout a highly disruptive and transitional period - 1970 to 2010. Secondly, it aims not only to track these material changes, but also to shed light on the cultures, communities, and belief systems of this traditionally underrepresented group of professionals. As the industrial and technological environment has shifted around them, the way this group organises, experiences, and identifies their working lives has shifted correspondingly.

With this in mind, it was clear that a qualitative research approach was fundamental to gathering appropriate and relevant data. Qualitative research methods allow the researcher to "understand the world from the subjects' point of view [and] unfold the meaning of people's experiences" (Kvale, 1996, 1). Of the many established methods that fall under the umbrella of qualitative research, this research is mainly concerned with qualitative research interviews. In recent years, interviewing and more immersive forms of ethnography have become a significant tool in the methodological armoury of film and television researchers. As a growing number of scholars attempt to divert their research away from a macro economic and policy

analysis on a national level, and focus instead on the identities and subjectivities of the under-represented workforce, television and production studies research is increasingly informed by ethnographic methods, such as interviewing and participant observation (Lotz, 2009; Mayer, 2011). As a research method, interviewing provides for the establishment of what Clifford Geertz has labelled "thick description" (Geertz, 1973), which goes beyond the simple recording of an event and attempts to communicate "the object of ethnography; a stratified hierarchy of meaningful structures" (Geertz, 1973, 6). Thick description provides a route by which production studies researchers not only list the practices and technologies of production personnel, but also convey a "sense of the ambience and texture of the industry's life as it is lived" (Gitlin, 1983, 12). As a result of this affordance, interviews feature as a common approach in numerous studies of this kind (Gitlin, 1983; Caldwell, 2008; Beck, 2003; Mayer, 2008; Mayer, 2011; Cornea, 2008; Gray, 2007; Dover, 2004; Lotz, 2009; Whealey, 2007) and will form the basis of this research.

The use of oral history interviews in television studies research is not without its criticisms. In the opening to her edited works on television historiography, Helen Wheatley has pointed to a number of methodological hurdles in television studies, of which, overcoming nostalgia in recollection is one. She argued that, in this type of study, there are often found narratives too full of either mournful loss or nostalgic sentimentalism. Borrowing from Carr (1990) in warning against the "romanticism of old men and societies" that exist within the retelling of past activities and cultures, Wheatley advocated that research of this kind be contextualised with macro-level studies incorporating industrial and economic enquiry. Furthermore, Christine Cornea (2008) discussed her own concerns that the recollections recorded in her interviews with high ranking production personnel could amount to a "carefully crafted performance" (Cornea, 2008, 120). However, significantly for this research, she went on to suggest that the historical nature of her enquiry freed interviewees to speak more candidly during the interview (Cornea, 2008, 120). From a practical perspective, Vicki Mayer (2008) has discussed the many difficulties of obtaining access to relevant high quality contributors and the tentative nature of these relationships while conducting such research. Particularly,

she has pointed to the difficulties experienced by young and early-career researchers, who lack the cultural capital of more established academics, in conducting this type of research.

In his 2008 study *Production Culture*, John Caldwell argued that research of this kind, particularly when heavily reliant on interviews, is hampered by the industry's obsession with overt self-reflection. In an era that is awash with 'behind the scenes' content, industrial self-analysis and 'spin', it is increasingly difficult for researchers to cut through the cultivated image and observe the true nature of production. As a result, Caldwell was critical of those who try to "directly analyse the social group" (Caldwell, 2008, 2) and advocates a "synthetic" approach that utilises the textual analysis of trade artifacts, interviews, and ethnographic observation in order to crosscheck any one piece of material. Many of Caldwell's concerns may not be applicable to this study, particularly due to the majority of those interviewed here being retired and the relative lack of self-reflection occurring in the television production industry during the era with which this research is concerned. There was very little, if any, 'making ofs' or 'behind the scenes' content in British television production for significant periods of the twentieth century, as evidenced by the work of the Adapt Project and Brett Mills (2008, 149). However, this study took into account concerns regarding the pitfalls of the over-reliance on interview data and adapted the methods used accordingly. As a result, this research primarily uses oral-history-style interviewing, but, like Caldwell (2008) and Beck (2003), it uses a combination of methods and a number of supplementary research tools in order to evade the inherent shortcomings of oral history. In doing so, it aims to keep individual data sets "in critical tension or dialogue with the others." (Caldwell, 2008, 4).

In addition to unstructured oral history interviews, this research relies on the textual analysis of a number of trade publications and resources found in the BBC's Written Archive Centre. Trade journals are well established as a research source for historical studies on film and sound technologies, as they provide a well collated and relatively easily accessible form of archival document and thus feature heavily in studies similar to this one. Lastra (2000) has used the *Journal of the Society of Motion Picture Engineers* (JSMPE) and *American Cinematographer* to trace the working practices of early sound engineers and their relationships with

their wider production colleagues. Beck (2003) has used *JSMPE, American Cinematographer,* and *Mix* as historical sources for tracing the introduction of the Nagra tape recorder into Hollywood film production and the subsequent reaction of, and negotiations by, sound crews. Jacobs (2012) used *JSMPE* and *American Cinematographe*r to show that the development of RCA's push-pull optical sound track redefined the process of re-recording as an important aspect of the post-production process. Furthermore, Quanz (2015) made use of *Playback* magazine to track the introduction of Pro Tools into the Canadian post-production market and the subsequent shift in the self-promotion carried out by threatened post-production sound personnel. Outside of sound-specific studies, Caldwell (2008) used *Variety* to supplement his ethnographic research on Hollywood film and television production and sees this as key to avoiding projected industry narratives or 'spin'. There is a clear precedent for trade journals to be used in such historical research and, due to their availability, these journals provide an effective way to triangulate the findings obtained from interviews, which form the bulk of this research. The publications analysed in this research are *Studio Sound, Resolution,* and *Line Up*. *Studio Sound* was first published in 1959 under the title *Tape Recorder*, as a monthly publication focussing on "all aspects of tape and tape recording" (Henslow, 1959, 7). *Tape Recorder* was rebranded in 1970 as *Studio Sound* to incorporate the growing field of cinema and television sound. *Studio Sound* provided significant reviews, interviews, and opinion pieces on numerous sound-related industries and aspects of sound until it ceased publication in 2001. Following its closure, *Resolution* was formed as an alternative title and is still in publication today. *Line Up* was the official journal of the Institute of Professional Sound and was published bi-monthly from 1988 until 2009. Since 2009, when the IPS was forced to cease publication due to the financial crisis, *Line Up* has existed as an online supplement to *Resolution*. The shared mission statements, readership, geographic location (Britain), and intertwining histories arguably make these publications a useful, yet still manageable, set of archival sources for this research. Furthermore, the content of these titles was heavily influenced by television sound operators as, during the era of vertically integrated broadcasters, they were an organised group of significant size within the wider sound community. As a result, these titles are seemingly highly suitable for a more structured and organised analysis of the self-reflections and social codes found within this community than analysis undertaken on indi-

vidual interviews. Beyond this, they are useful sources for tracing more precise information regarding individual technologies, which is often lacking in the recollections of interviewees, and provide a further source through which to analyse the sound operators' changing practices and reactions to technological change. Such publications are generally focussed and financially reliant on the advertising of new pieces of equipment and, therefore, require that the reader is consciousness of the influence of marketing and industry 'spin'. Nonetheless, they remain a useful effective and easily accessible source with which to triangulate and scrutinise interview data.

Supplementary to these two core research methods, analysis is also undertaken based on the research activities of the Adapt Project, which are known as "simulations". This unique method of research is influenced by the emerging field of experimental media archeology in its use of reenactments and the "de-auratizing" of historical artifacts (Fickers & Van de Oever, 2013). These simulations reunite retired television production staff with working examples of the now redundant technologies of their era. Beyond simple discussion or explanation, the participants in these simulations actually relive their working practices, using the same working practices as they had in the past to complete a number of complex productions, including a 16mm film documentary and a full colour outside broadcast (Murphy, 2016). Simulations are comprehensively filmed, from multiple angles, with both fixed and roaming cameras to capture unnoticed and unspectacular working practices, while also allowing for a subsequent comprehensive analysis of events. This methodology provided two significant research opportunities for this thesis. Firstly, the author was able to be actively involved in the production of these simulations, which comprised a number of shoots, of up to a week in length, during which the author was able to observe the participating sound operators' historical practices as they would have been on a daily basis throughout their careers. Although short, this research exercise at least added a minor element of ethnographic research supplementary to the more substantial sets of research data. The second research opportunity comes from the resulting hours of video data, which offer a further source for more meticulous analysis of the working practices, technologies, and hierarchies at play amongst production crews of this era.

Oral History Interviews

'Unstructured' oral history interviews make up the bulk of the research conducted for this thesis. In total, 53 interviews were conducted, of which, 22 contributors worked as sound operators on the in-studio acquisition process, outside broadcasts, or 16mm film crews. A further 14 worked in post-production sound. Among these participants all standard sound roles were represented (see Chapter 2 for details of these roles), although sound recordists and Outside Broadcast (OB) sound supervisors were overrepresented in comparison to their colleagues. A further 8 interviewees represented manufacturers, being either a founder, a current director, or a current employee of a number of companies which produce industry-standard technologies. Among these manufacturers were SQN Mixers, AMS-Neve, Rycote Windshields, Black Box Video, Richmond Film Services, and Oscar-winning independent developer Chris Woolf. While, unlike the other companies interviewed, Richmond Film Services is not a manufacturer of equipment, it is an industry leading hire company and large unit buyer, thus offering sufficient insight into trends in equipment manufacture, innovation, and consumer choice. The final nine interviewees comprised those working in 'above-the-line' roles, including producers, executive producers and directors. The interviews with manufacturers and above-the-line staff were conducted in order to incorporate an element of "critical dialogue" into the oral history data, so that the accounts of any one social group could be cross-examined using the accounts of a different group and external sources. As subsequent chapters will show (particularly Chapter 4 and Chapter 6), the individual social groups interviewed have wildly varying objectives, skills, and experiences and, as a result, their accounts often contain differing perspectives. The inclusion of accounts from social groups who are not the central focus of this research, particularly above-the-line staff, offers an opportunity to contextualise and further scrutinise the accounts of the focal group.

In an attempt to attract a broad range of contributors, interviewees were sourced from a number of channels. Initially, calls for participants were placed in *Prospero*, the Newspaper

for BBC Pensioners, and in the ARTS Quarterly, the publication of the Association of Reunited Thames Staff. These publications were chosen due to the known active communities attached to them but also because, at the time the call for participants was published, the Adapt Project was known to, and seemingly well received by, both communities through its own efforts to attract participants for upcoming simulations. ARTS represented an opportunity to reach potential contributors from a community without an association with the BBC. Furthermore, for the sake of pragmatism, ARTS provided the benefit of being an active community in geographic terms, so as to allow for the interviews to be conducted in a manner consistent with the methodology of other interviews - unstructured long-form face-to-face interviews.

Beyond the contact made with the above-mentioned publications, calls for participants were posted on the online members' forum of the Institute of Professional Sound and circulated via the mailing list of the (BBC) Tech-ops History website. The Institute of Professional Sound (IPS), formerly the Institute of Broadcast Sound, is a widely recognised body, with a membership of over 500 sound professionals from a number of industries. It aims to provide training, community, and a voice within the wider industry (Institute of Professional Sound, 2017). The IPS provided an opportunity to seek interviewees distinct from those within the other communities, namely sound professionals who were still working and unattached to a major broadcaster. The final semi-organised community approached for participants was Tech Ops, a website and associated forum collated and managed by former BBC engineer Bernard Newham. This community is very active and was undoubtedly the most fruitful in providing relevant, enthusiastic, and high quality contributors. The keen response from this community was a contributing factor in the overrepresentation of the BBC in this research which, while, of course, is not an issue unique to this research, does still remain a valid criticism.

In addition to this more active pursuit of contributors, 'snowballing' played a significant role in sourcing contributors, with interviewees introducing colleagues as new potential contributors, particularly when they possessed a specific area of expertise. Above-the-line contributors were mostly sourced via connections with members of the Adapt Project, signifi-

cantly the project's Digital Producer, Amanda Murphy, and the author's colleague from the PhD program, Rowan Aust. Again, snowballing led to contact with other potential contributors of this kind. Manufacturers were approached directly once a significant number of interviews had been conducted with sound operators, allowing for interviews to reveal technologies and manufacturers significant to the research. Unsurprisingly, a number of manufacturers did not reply or declined to be involved, while a number were also deemed unsuitable due to geographical and logistical factors, including companies such as German microphone manufacturer Sennheiser. Although Sennheiser has a significant sales and marketing presence in the UK, their research and development is conducted in Germany, with any supplementary documentation most likely being written in German. Those manufacturers that did reply were generous with their time and, due to the historical nature of the research, surprisingly candid in their accounts.

The chosen method of interview was unstructured face-to-face interviews, which allowed for the interviews to take the form of "a conversation that has a structure and a purpose" (Kvale, 1996, 7). Preliminary interviews were conducted by phone to assess suitability as well as to make the interests and intentions of the research known prior to the main interview, in an effort to reduce uncertainty amongst interviewees and, therefore, ensure the most effective use of interview time (Kvale, 1996; Gorden, 1956; Jones, 2004). A very small number of interviews were conducted via phone due to the contributor not wanting, or being unable to, complete the interview face-to-face. However, the vast majority were conducted in person. The shortest interview lasted 50 minutes, while the longest ran for over four hours, with an average interview time of roughly ninety minutes. While, clearly, this generated significant amounts of data to process, due to the relatively small sample size, it was decided that the time to be dedicated to data processing was a worthwhile sacrifice given the benefits that this type of interviewing provides.

Unstructured interviews were chosen due to the extensive and personal nature of the information that is this research aims to uncover. When attempting to understand not only the technologies and practices of sound operation but also the communities and meanings behind

them, it was important to deploy an interview technique efficient in "uncovering the social meanings that lie behind social action" (Mcneill and Chapman, 2005, 33). Unstructured interviews produce rich responses and allow to contributors to properly communicate personal meaning and significance beyond simple factual points (Jones, 2004; Punch, 2005; Oishi, 2003). The length of time dedicated to such interviews, as well as their resemblance to general conversation, allows for the building of rapport and trust between interviewer and interviewee. This was considered important when asking interviewees to discuss potentially negative or contentious issues regarding their careers. The interviews also involved a significant element of self-reflection on the part of the interviewees and discussion of their work, identities, and potential failings. Due to the demographic group of the majority of interviewees (white, middle-class, British and male) and the general hesitance to engage in self-reflection, it was clear that a flexible approach to interviews, in which a good rapport could be established, would be necessary to extract quality data.

Conducting interviews face-to-face was the preferred method for two reasons, the first of which being the general benefits of face-to-face interviews, which allow for the added assessment of nonverbal communication, such as gestures and facial expressions (Creswell, 2007; Neuman, 2011, 2004; Oishi, 2003). This provides important supplementary data as through such body language "we can communicate, for example, interest, encouragement, warmth and caring on the one hand or boredom, disapproval, coldness and indifference on the other" (Jones, 2004, 258). Furthermore, face-to-face interviews better enabled the avoidance of the 'us and them' paradigm (Cornea, 2008), which often occurs between academics and research subjects taken from an industrial context. This paradigm was arguably all the more pertinent to this research, as the interviewees are a group of professionals with their own social codes and hierarchies, who posses a highly developed set of skills. As a result, it was important for the author to be conscious of his status as an outsider and to maintain the reflexivity necessary for "studying up" (Herzog & Ali, 2015). When discussing her own experience of studying up, Vicki Mayer has stated that the success of such interviews and ethnographic research seems "to depend very much on who we are, the social worlds we inhabit." (Mayer, 2008, 143), while John Creswell stated that an interview is inherently a "hierarchical relation-

ship with an asymmetrical power distribution between interviewer and interviewee" (Creswell, 2007, 140). Furthermore, in his writing on the interviewing of elite groups Kvale argued:

> Sound knowledge of the interview topic will gain respect and be able to achieve an extent of symmetry in the interview relationship (Kvale, 2007, 70).

By conducting interviews in person and adopting an interview technique that mimics general conversation under minimal time constraints, I was able to share my own knowledge of the subject and experience of working within the social world of sound operators. This undoubtedly helped level the uneven relationship between interviewer and interviewee when "studying up". As a result, it was possible to build the rapport and trust necessary for successful interviews seemingly very efficiently. Beyond the author's own "sound knowledge of the subject area", his involvement in the Adapt Project seemed to assist in levelling this uneven relationship and, for some interviewees, added legitimacy to the research. Similarly to Mayer's (2008) use of "name dropping" to achieve social status when interviewing, the association between this research and the numerous high-ranking academic and industry personnel involved in the project was helpful in overcoming some barriers for participants. In addition, the ambitious research objectives, methods, and considerable funding of the project, held significance in certain situations. The vast majority of below-the-line sound operators seemed content with the author's individual qualifications and experiences as markers of his suitability to conduct such research. For these interviewees, the size and scope of the wider project was certainly a point of interest and curiosity but not a defining factor in their involvement. However, when approaching above-the-line personnel as well as senior figures at the manufacturers, where the studying up issues were more pronounced, greater significance seemed to be placed on the context of the research, beyond the purpose of producing a PhD thesis. There is little doubt that, had the study been conducted outside the scope of a major research project with significant resources and high profile personnel, the author would not have enjoyed this level of engagement from this group of contributors.

During the interviews, considerable effort was made to uphold a good standard of interview practice, such as listening, asking clear questions, not leading answers in a particular direction, and maintaining rapport while conveying an appearance of interest and enjoyment. Ackroyd and Hughes have argued that researchers "must communicate trust, reassurance and, even, likeableness to the respondent so that the latter's interest and motivation are sustained" (Ackroyd and Hughes, 1992:108). With this in mind, effort was made to give interviewees feedback and continually encourage their engagement with the interview process.

Representation

With regards to representation this pool of interviewees is, unfortunately, far from a broad cross section of society. The vast majority are white middle class men who joined the BBC during its years of expansion in the late 1950s and early 1960s. Whilst best efforts were made to interview people from both genders and of differing social backgrounds, this proved an extremely difficult task when seeking sound operators employed during the period of vertical integration and mass employment by the BBC and ITV franchises. Throughout this time, television production was dominated by a few narrow social groups and, like many industries, failed to represent the wider communities which it served. During the years of expansion the BBC was well known for recruiting those leaving the armed forces who, having completed their national service, would be put to work in technical and engineering roles. Following the end of national service, the narrow and strictly upheld entrance criteria for those going in to technical roles again acted to limit the pool of applicants. As a result, below the line technician roles were filled almost exclusively by young non-university educated men, a social profile which is largely consistent throughout the interviewees for this research.

Whilst not representative of society as a whole, theses interviewees do undoubtedly reflect the television industry during the time with which this thesis is concerned and is successful in providing a representative pool of contributors from a range of sound specific job roles.

Amongst the 53 interviewees, there are 22 contributors working in sound acquisition roles (either in studios, outside broadcasts, or 16mm film), 14 from post production roles, and 9 from above the line production roles (the remaining 8 interviewees represent manufacturers). Whilst this split may seem skewed towards those working in acquisition, this undoubtedly reflects the nature of these differing roles and the resources allocated to them by the BBC and ITV franchises.

At its peak, the BBC Film Department employed more than 50 film crews and each BBC region had its own fleet of multiple OB trucks, each of which required a team of three operators. However, whilst it required a distinct crew to record each project, often shooting in distant locations and for many weeks at a time, it required a much smaller team to complete the post production processes. Working from their permanent bases, post production sound operators could edit and mix a 60 minute drama or documentary, that may have taken many weeks to shoot, in just a few days. Furthermore, the technological infrastructure required for post production could easily cost broadcasters millions of pounds to purchase and install for just a single dubbing suite. This, in combination with post production operators' ability to work much faster than crews could shoot, meant that the number of operators employed in post production sound roles was significantly less than that of sound acquisition, as is apparent in the pool of interviewees for this research. With regards to the genres of programmes worked on by the interviewees, a full range of programming is present in almost every interviewees' work. Whilst some specialisation did occur, this was relatively rare and only open to the most experienced of operators. The vast majority of those interviewed would have had little, if any, control over which programmes they worked on and, as such, found themselves working on almost every type of programme produced within their particular discipline. For example, it would be common place for a film sound recordist to work on a primetime drama immediately after working on news inserts or fly on the wall documentary. Similarly, OB crews followed their trucks to whatever event it may have been allocated, whether it be Question Time or the Grand National. Some operators did specialise throughout the later stages of their careers but, even for those privileged few, this came after many years of working, as ordered, on a full range of programmes.

Clearly, whilst the interviewees of this thesis cannot be seen as representative of society as a whole, they are undoubtedly representative of the industry, and communities, at the heart of this study and offer a comprehensive insight into the work of sound operators across the multiple sectors of television production.

Ethical Concerns

The main ethical concerns for this research centred on the reputation-based nature of employment within the television production industry. While, fortunately, the majority of contributors were retired, a significant number still continue to work, almost all of them in a freelance capacity. Therefore, consideration was given to the potentially negative consequences of individual accounts regarding work and working relationships, particularly the often critical recollections regarding colleagues in above-the-line positions. As a result, it was decided that anonymity would be given to all contributors, regardless of their employment status. When their accounts are used in this thesis, their names have been replaced with their job title and a number to differentiate them from other contributors, such as “sound recordist 1”. Coinciding with anonymity, confidentiality was also assured. While no formal confidentiality agreements were signed, clear verbal notification was given that all raw research data would be kept confidential. Under this verbal agreement, any use of interview data, such as this thesis and related publications, would be subject to anonymity, as referenced above. As a result of this, no research data was shared outside the Adapt Project research team and all data was stored securely. In addition to ethical implications, it was hoped that such anonymity and confidentiality would encourage interviewee confidence in open and frank discussion. Finally, in keeping with good practice (Neuman, 2011; Punch, 2005; Creswell, 2007), all interviews were conducted with the interviewees informed consent. Full information was provided regarding the author, the project, and the intended use for the data subsequently obtained. Furthermore, contributors were given the option to withdraw at any time and to contact the author with their concerns or follow up questions.

Who, What, How?

This chapter lays out some important foundational information regarding the people who make up the focal point of this research - television sound operators, outlining the differing roles that make up operational television sound, as well as the practices, expectations, and concerns of those who occupied these roles during the era of vertically integrated broadcasters. Furthermore, this chapter will outline some significant examples of the many tools and technologies that were used by these operators to achieve their aims and objectives, as well as the objectives of the overall production. Throughout chapters 3-7, a great deal of analysis shall be focused on the adaptation and changing experiences of this group of professionals, as a result of numerous, and significant, disruptions. The period on which this work focuses is one of unprecedented industrial reshaping within broadcasting, as well as technological developments that led to the tools of their profession becoming fundamentally different to their predecessors. This study documents and analyses the experience of this group as they react to these external influences, in relation to such issues as their training, working practices, professional identity, and industry status. However, in order to fully address the arguments constructed in later chapters, it is important to first identify and explore the structure, practices and technologies of the social groups at the heart of this research, during the period of relative stability that preceded the above-mentioned changes and the current context in the industry.

After the disruptions of World War II, and the immediate rebuilding effort, television in Britain is widely seen as entering into the “years of expansion” (Briggs, 1970, Pawley, 1972). The Television Act of 1954 established the Independent Television Authority and paved the way for independent television in the UK, which began broadcasting the following year. By the 1960s, the BBC and ITA were in the process of developing colour television and, in 1964, BBC Two was officially launched. The BBC purchased Ealing film studios in 1955, which, following some years of adaptation, became a central hub of BBC production until 1995. Television Centre was officially opened in 1960 with the aim of replacing Lime Grove Studios as the BBCs main television studio facility. However, to deal with the rapid expansion of television production, Lime Grove continued to be a significant site for BBC production and would remain so until 1991, despite being purchased as a temporary measure in 1949. Perhaps more significant for this research, the late 1950s and early 1960s saw a shift in the

BBC's recruitment policies. As 'operator' functions were increasingly being separated from hard 'engineering' functions, staff intake doubled to service these new roles. With the end of national service in 1960, the BBC shifted away from its traditional recruitment of ex-service personnel and, by 1963, schools leavers made up the majority of new entrants into the Wood Norton training centre (Pawley 1972). Often referred to as a period of "comfortable duopoly" by academics (Ursell, 2000b; Born 2004) and continually referred to as a "golden age" by interviewees, the working environment of this era was characterised by stability, cohesion, and clarity. It was in this period, from the mid 1960s until the industry-wide reengineering of the early 1990s, that the vast majority of those interviewed for this research began their careers and developed their practices. This working environment, shaped by the vertically integrated nature of broadcasters, undoubtedly had huge influence over the working practices, technologies, and identity of those working in television sound. The fundamental reengineering of the television production industry has altered this environment dramatically. However, to fully illustrate the extent of the shifts documented in the following chapters, it is imperative to understand the working lives of sound operators in this "golden age".

This chapter is not an exhaustive account of the practices and technologies of those working in operational sound, nor is it a complete guide to the practices involved in operational sound roles. Furthermore, some technological developments do not feature in this chapter, but are included in later chapters so as to more accurately analyse their role in evolving professional practice. However, this chapter does provide some foundational information about who these people were, their practices and priorities, and the technologies they used to implement these practices.

Identifying Television's Sound Operators in the Era of Vertical Integration.

As previously stated, 'Television sound operators' is a broad term that encompasses multiple and unique social groupings which do not necessarily share working practices or professional identities. Whilst 'sound operator' is a label that almost all interviewees would identify with, and a useful term when addressing industry wide issues and trends, it should not be mistaken for a specific job role. Throughout this chapter, a number of the specific roles that make up this wider community shall be discussed and explored in detail. The roles most pertinent to this thesis, and therefore discusses in most detail are; location sound recordist and assistant, OB and studio sound supervisor and assistants, and, finally, dubbing mixer and their assistant also known as a gram op. In the era of vertically integrated broadcasters, these social groups achieved a heightened level of homogeneity through generic basic training (see Chapter 3) and the shared remit and environment of their mutual employer. However, the professional skills, practices, and technologies of these various individual roles, were, and still are, separate and distinct. For example, someone working as a studio boom operator would have little skills or knowledge overlap with a colleague working as a dubbing mixer, yet both would clearly identify themselves as working in television sound. As such, this chapter aims to give a foundational insight into the practices and technologies of the distinct professional groups found within the wider label of 'sound operators'.

The most obvious divide in television sound personnel is that between those working in production/location roles and personnel working in roles in post-production. These subcategories are themselves broad and encompass multiple roles and practices that can differ significantly between types of production. However, these terms are widely accepted among those within the industry as differentiating between those who work on location, as well as in studios, capturing sound as the content is performed and shot, and those who work on constructing the soundtrack of a programme after the initial acquisition has taken place and a picture edit has been produced.

For those in production sound roles on location, or indeed in the studio, their role was undoubtedly one of collaboration, flexibility, and compromise. For much of the era of vertically integrated broadcasters, single operator, or skeleton crew, working arrangements for sound were neither technologically possible nor practically desirable. As a result, the capture and recording of sound was the responsibility of teams of variable size, depending on the type of production. Within these teams, roles were clearly defined and practices honed to a high level of efficiency.

A production working on film, as was the norm for most documentaries and dramas, would routinely be staffed with a senior sound operator known as the sound recordist and at least one assistant. While there were exceptions, such as particularly intimate documentaries and news reports, a team of two sound operators and a recordist accompanied by an assistant was the standard on most film shoots. For sound recordists within the BBC, there was no formal specialisation, meaning that all recordists worked on a range of shoots. However, many interviewees spoke of the informal relationships they had formed with particular colleagues with whom they regularly worked, such as camera operators and directors. In the event of such relationships and working preferences, a recordist did have some informal ability to tweak rosters so as to be assigned to a particular project. It was also not uncommon for directors to request specific sound recordists with whom they enjoyed working. As a result of this informal specialisation, casual 'teams' of production staff were not uncommon.

As the junior sound operator, sound assistants did not specialise, even informally, as working on a range of content was seen as vital to their future work as sound recordists. Despite being a junior role, the BBC's 'dead man's shoes' policy meant that many sound assistants could remain in their post for many years before being promoted to sound recordist.

While sound assistants have since been dropped from all but the most well-funded drama shoots, the limitations and characteristics of analogue sound technologies gave rise to a number of crucial preparatory and organisational tasks. The 1960s also saw the development of the first truly high fidelity ¼"recorders, notably the industry standard Nagra series of

recorders. The year 1958 saw the first release of the Nagra III tape recorder (see fig. 1), a fully transistorised monorecorder, which offered vastly improved performance over existing valve based ¼”machines, such as the EMI L2 and Perfectones (Ellis 2012: 38).

Fig. 1: Nagra III ¼ Inch Tape Recorder (Photo: Radio museum, 2017)

The Nagra III was succeeded by the Nagra IV in 1969 and the 4.2 in 1972 which, due to its considerable reputation for reliability and performance, would continue to be the dominant industry standard recorder for more than 20 years until the gradual introduction of videotape (See Pages 148-150) (Nagra, 2016). Recording at 7 inches per second onto Long Play ¼ inch tapes, these machines gave a maximum record time of 20 minutes. Responsibility for organising and managing these tapes during the shoot fell to the assistant, who would be tasked with loading the recorder with fresh tape, labelling used tapes, and, significantly, keeping track of the remaining tape on the current reel. While these tasks seem rather mundane, almost all interviewees point to the considerable thought they gave to these tasks and the importance of being ready with sufficient tape at all times. One location sound recordist, whose first outing as a sound assistant came on the BBC’s adaptation of John Le Carre’s *Tinker Tailor Soldier Spy* (1979), spoke of the importance of ensuring sufficient tape supplies, so as to avoid embarrassment during filming:

> You'd check first if you had enough batteries in the machine to last, enough tape with you so you wouldn't run out of tape at the wrong time, you'd always have spares with you so you were all self-contained so you could go off and do everything half a mile away from the car where everything else was and you wouldn't have egg on your face when somebody said 'well I thought we'd do this now' and you didn't have enough [tape] and therefore kept everybody waiting (Sound Recordist 1).

A former sound assistant again highlighted potentially running out of tape as a significant concern when recording:

> One of the big disadvantages with this machine compared to modern machines is that you've got no idea, unless you keep taking a look, when you're going to run out of tape so you've got no indication, you could be running around in documentary mode doing a long interview, it might be over your shoulder and the next thing you know you hear the tape flapping around inside the machine [...] you'd end up running out during the interview mid-sentence when you're filming but you didn't have much indication (Location Sound Assistant 1).

A further sound recordist, who spent the vast majority of their career at an independent production company, working primarily on light entertainment, again stated the importance of these seemingly routine tasks:

> The film rolls lasted 10 minutes, a Nagra roll was 22 minutes at 7 ½ inches per second. And so what you tried to do was arrange it so that every two rolls of film you changed your tape at the same time as they changed the mag. What you really didn't want to do was run out of tape because then you'd have to cut, there was no point in them filming without sound, so you'd have to cut which could be a bit embarrassing (Sound Recordist 2).

Clearly, while these tasks may seem routine or even trivial in hindsight, during the era in which all recordings were made on analogue magnetic tape, maintaining an adequate ready-to-use supply of tape was a significant concern. Comments from sound recordists 1 and 2 regarding "having egg on your face" or a situation being a "bit embarrassing" if a recordist failed in these duties are particularly revealing. For those working as sound recordists and assistants at that time, these relatively basic working practices were a very simple indicator of competence and professionalism. Failure in these tasks was not only inconvenient but also a source of personal embarrassment, as the failure to stay on top of these tasks was seen as a failure in basic professional practice. The fundamental nature of these practices is clear in the words of one sound recordist who stated that "it was a given that we'd turn up with an adequate supply of tape and keep the machine loaded!" (Sound Recordist 3).

When shooting commenced, the sound recordist was responsible for setting levels and mixing the sounds of each input into the recorder. Depending on the type and complexity of the shoot, the assistant may have been tasked with operating the boom (the skillful act of maneuvering a microphone on an extending pole so as to get as close to the sound source as possible), but it was often the recordist who would both mix and operate the boom simultaneously. When working in the era of ¼ inch tape recorders, inputs were limited and the number of microphones that could be used at one time was correspondingly low. The Nagra IV tape recorder, the standard tool for sound recordists until the late 1980s, had two microphone inputs and one line input (although this could be converted to provide a third microphone chan-

nel). While auxiliary mixers could be used to increase available inputs, these were cumbersome and added yet another piece of equipment to the bulky armoury of equipment that had to be carried and operated whilst shooting. As a result, the use of microphones was, for the most part, kept simple with often only a solitary boom mic in use.

Unsurprisingly, given television's traditional obsession with intelligibility, the acquisition of clear undistorted dialogue was of paramount importance to sound recordists working on both documentary and drama. However, microphones posed a number of difficulties when working on location and required significant skill to operate. Radio microphones of this period were extremely unreliable, transmitting on VHF frequencies to single antenna receivers. As a result they were prone to frequency drifting at the transmission end and drop-outs at the receiving end, meaning that they required constant monitoring. These difficulties were felt across the entire spectrum of production sound, including film recordists, OB sound crews, and studio sound operators. One ex-OB sound supervisor, who specialised in golf coverage and, therefore, became highly skilled in radio mic operation due the considerable size of the golf courses that required sound coverage, stated that, for the early part of his career, radio mics "were a luxury. They didn't always work, they were a mess really, nobody wanted to touch them" (Sound Supervisor 6) . A location sound recordist from the BBC's film department argued that "it was almost an affront to a sound recordist to use a radio mic, you only used radio mics as a last resort" (Sound Recordist 1).

Discussing some specific issues surrounding radio mic use, one sound supervisor, who started his career working in studios before moving on to OBs, argued that such issues were so severe that radio mics were almost completely absent from studio work. He also stated that, even when working on OBs and with the significant technologies at their disposal, sound supervisors could still only hope to use a small number of radio mics:

> BBC TM3s were the first I used. They were notoriously difficult. They were on VHF band and you'd never expect to use more than four together or you'd get intermodulation problems. I don't ever remember using them in studios at all, but we did on OBs. The scanner was equipped with four receivers and that was all they had, and those were tuneable receivers, they looked like an old radio set, you had to tune them manually. But, you certainly tried to steer clear of radio mics at that point (Studio and OB sound supervisor 1).

Another sound supervisor, with a similar career path, also points to the absence of radio mics in studios:

> Radio mics were so rudimentary you'd have never used them for drama [in studios]. Hitchhikers Guide to the Galaxy (1981) was probably the first drama done almost entirely with radio mics [...] that was, I think, very early 80s. I had moved to OBs by then, but there was a lot of chatter going round 'Hitchhikers has been done on **radio mics**!' that sort of thing [...] When I worked in studios they sometimes might have been used them for a difficult bit of Blue Peter something like that. But they were still rudimentary and so booms stayed on for a long time in studios (Studio and OB sound supervisor 2).

Figure 2 shows the TM3 transmitter cited by this interviewee as being used in conjunction with a RCA BK6B. More significantly, it shows the size and design of the corresponding RC4 receiver. Clearly, despite being designed for use on location, the receiver was significant in size. What is also clear is the prominence of the tuning knob and dial, which would have been used to continually adjust and re-tune to the drifting frequency of the transmitter.

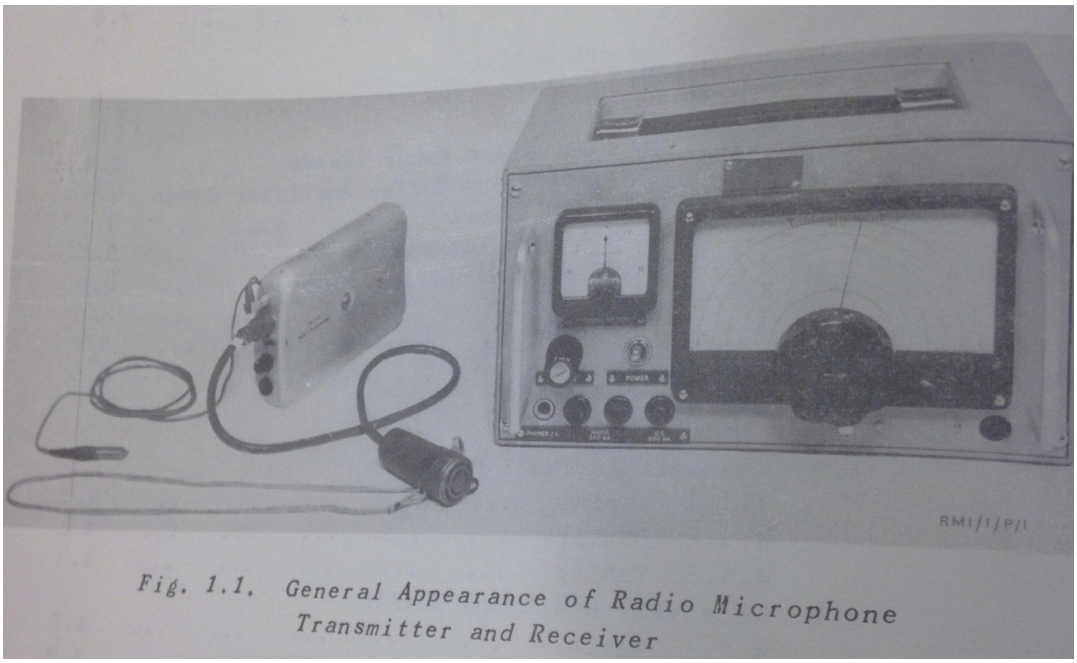

Fig. 2: BBC TM3 Radio Mic Transmitter/RC4 receiver with RCA BK6B mic (Photo: BBC WAC)

Significant improvements in radio microphone technology would lead to the now ubiquitous use of radio mics in almost all types of television production (see pages 150-152 for more detail). However, prior to these developments, the use of a boom was the standard approach for obtaining sound on location. sound recordists were relied upon to use skill, gained from experience, to position the boom in the most effective area, while never straying into shot or casting unwanted shadows across the frame. When a boom mic was unable to obtain the required sound, such as in a wide shot or in a heavily lit scene, recordists would often resort to concealing cabled microphones in discreet yet effective positions. By strategically bringing the level up and down when necessary, this allowed the recordist to achieve a close-mic sound, thus mimicking a boom without ruining the shot. While undoubtedly labour intensive itself, and relying on significant skill to adjust the level of the concealed microphone at the correct times so as to not muddy the overall mix, this approach was largely seen as preferable to relying on radio mics. When interviewed, one sound recordist spoke at length of the efforts he went to in order to acquire good quality sound regardless of the composition of the visual frame, even under the technological limitations of the time:

> Most people tried to avoid radio mics at that time because of their unreliability, interference, wind and clothing noise that sort of thing. You tended to, wire them [actors] up just in case they went out of range but you tried to do everything on the boom for quality [...] On drama there were occasions where me and my colleagues would not just use the boom for dialogue but you'd used hidden mics around the room. So if someone was walking up to a door and knocking the door you might hide a personal mic near the door somewhere so when they walked up to the door and it was wide shot. You'd see the guy walk up and you'd get traffic passing in the background and then leading up to the door you fade up the hidden mic either [...] you were limited by having one sound assistant and he might not be able to reach with the boom someone deep in shot. so you would hide a mic and you would only fade it up enough to make it sound the right perspective for that size of shot (Location Sound Recordist 4).

During the Adapt Project's 16mm film simulation, a further sound recordist also pointed to the importance of getting the appropriate microphone in the correct place so as to ensure the best quality sound. As with the interviewee quoted above, this contributor points to the practice of using microphones in non-standard ways, in order to work with the composition of the frame without compromising sound quality:

> The whole object of course with microphones, which makes the sound assistant's job absolutely imperative, is the choice of the mic. If the mic is not in the right place, the best sound recordist in the world cannot cope with that, it would produce less than the best sound you could get. [A tactic used was] to put them [microphones] on a table where there is something small, if the camera is in a fixed position you can actually put it right in shot on a table so that its just nicely hidden. I remember doing that with a pole when I had to get some sound in Jersey in a big conservatory and the only way of getting the mic in for this wide shot, which was taken from outside the conservatory, was to get the boom and the mic nicely lined up with edge of a door inside so it couldn't be seen, there was all manner of little tricks (Sound Recordist 5).

Another documentary sound recordist also discussed the importance of well utilised microphones and the steps taken to ensure good microphone coverage:

> Most of the stuff we did then could be done on one boom mic and one radio mic but, the radio mics weren't very reliable. [Therefore] You had to get very good at being just out of shot [with a boom]. Because the cameras that were used in those days had a manual zoom on them with a little lever on the side. And so you got really adept at knowing how tight the shot was depending on the lever. You'd watch this lever and if the cameraman zoomed in you'd bring the mic down. Also, if the cameraman saw the boom coming into shot [they would signal] and so you learned to watch the zoom bar and the cameraman far more than watching what you were recording. There was a lot of important skills like that to learn (Sound Recordist 6).

Clearly, in the era of analogue sound equipment, when radio mics could not be relied upon, effective microphone selection and use was of paramount importance to the work of sound recordists. Due to the overriding position of dialogue in the television soundtrack, this clearly was, and continues to be, the primary concern of those working as sound recordists. Consequently, considerable effort was put into achieving clear intelligible dialogue, despite the limitations of the available technologies.

For sound recordists, and their colleagues working in studios and on OBs, the selection of available microphones was both limited and fairly standardised. While using a boom mic for dialogue was less common on OBs due to the nature of the events being covered, they did use much the same microphones, albeit for different purposes. For the majority of the 1960s, the boom and effects mic of choice was the AKG D25 (see *Fig. 3*).

Fig. 3: AKG D25 (Photo: Old-Mics, 2017)

First released in the 1950s, the D25 was a dynamic microphone with a cardioid pick up. While its cardioid polar pattern allowed for the effective acquisition of dialogue, it lacked directionality over longer distances (AKG, 2017a). As it was used in an opaque spherical wind gag, it was imperative that the D25 was mounted correctly as, due to the cardioid pattern, only one side of the microphone picked up the full range of sound. However, due to the flat and symmetrical shape of the D25, there was no indication as to which was the 'live' side

without listening to the incoming sound signal through the tape recorder. Discussing this issue, a sound recordist stated:

> I remember being a trainee putting the mic in the gag like that [the wrong way up] and the recordist was saying that the sound was 'strange', of course I was pointing the back of the microphone at the person doing the speaking. It made my recordist quite grumpy (Sound Recordist 4).

By the end of the 1960s, the AKG was replaced by the Sennheiser MKH series of shotgun mics which would go on to be the dominant location gun mic until the present day, due, in part, to its rugged reliability and performance in wet conditions. First showcased at the German Industrial Fair in 1961, and officially launched with the model 104 the following year, the MKH series were a range of radio frequency condenser microphones[2]. Requiring external powering, these condenser mics utilized 12v T-power (Tonader power), as this provided interference-free powering and had the advantage of using less power than 48v phantom powering (Hibbing, 2016, 2). The MKH series first entered into use at the BBC in the form of the MKH 805 and 405 shotgun mics (Harwood, 1966). A cardioid mic of over half a metre in length, the 805 had exceptional directional qualities, leading to it being used extensively in outside broadcasts, particularly for sports such as golf and tennis, for which the ability to pick up sound from a significant distance away was a highly sought after characteristic. However, its size and extremely directional pick up made it unwieldy and largely unsuitable for indoor use. For these purposes, the 405, a smaller and less directional version of

[2] It is important to note that "radio frequency" here refers to the internal circuitry of the microphone design and not wireless "radio mics" in the traditional sense (although these mics were often used with radio mic transmitters on broadcasts such as golf or other sporting events). Briefly, these microphones work in a similar fashion to normal condenser mics, but rather than the diaphragm movements and subsequent change to the capacitance being converted directly into an audio signal, this modulates a fixed radio frequency set by an oscillator in the microphone. This modulation is 'received' and then converted into a sound signal, but at a much lower impedance than in normal condenser mics. The whole process happens in the microphone, with the transmitter and receiver directly wired to each other. The only output from the microphone is a sound signal which then has to travel down a cable to its destination. This process avoids impedance mismatching, which was a problem in condenser mic design when transistors first replaced valves.

the MKH shotgun series, became the de facto standard, as it offered similar but more manageable performance. The 805 and 405 models would be replaced during the 1970s by the 815 and 415 models, which, in turn, were superseded by the 816 and 416. Figures 4 and 5 show the comparative size difference between the popular 815 and 415 MKH models. Throughout these upgrades, the MKH series retained its respected status, not only for its performance but also for its rugged durability and ability to perform in the wet. Its transformerless RF circuitry meant that the MKH microphones did not suffer the same vulnerability to moisture as other microphones.

Fig. 5: Sennheiser 815t (Photo: Audiofanzine, 2017)

Fig. 4: Sennheiser 415t (Photo: Wickert, 2017)

Discussing the MKH series, Nigel Woodford, who began his career as a sound recordist at the BBC before leaving to form his widely respected hire company Richmond Film Services, stated:

> Then there were various improvements the 805 got replaced by the 815, which was a bit quieter, and then the 816 which is still very much in service today although Sennheiser have now stopped making it. Then the 416 which is a shorter gun mic, a bit less directional but actually a bit nicer sounding and more handy to work, as it wasn't anywhere near so long, became very popular and that is also still very much around today. It must be one of the most popular gun mics ever made but they are very reliable people put them around football pitches and leave them out in the rain and they still work and that sort of thing (Nigel Woodford, 2016).

During a separate interview, one OB sound assistant recalled his first time using a Sennheiser MKH 415 when working as a sound assistant on a golf tournament:

> On one tee with the camera behind, [the sound supervisor] said "Quick, stick your 416 on the end of the cable and put it on the top of the wall!" Well, what happened next changed the way tee-offs were covered for ever! There was a huge explosion of sound as the golfer struck the ball. [The sound supervisor] had far too much gain in the channel. [The Director] was shouting "what the hell was that?". You see, the previous choice of tee mic was an old [ST&C] '4035' an old moving coil thing. These were placed on the tee line marker, really close but were just useless, at best emitting a little click as the golfer made his shot. Anyway, [the sound supervisor] was on the phone back to base and ordered 10 more 416s for delivery ASAP. (OB Sound Assistant 1).

While the details of such stories are always questionable, this undoubtedly shows the considerable reputation that the MKH series gained among sound operators both on OB and film shoots.

While the Sennheiser MKH series became the standard shotgun mic used throughout television production, sound recordists and those working in studios and OBs, had a range of other microphones for a number of different functions. Personal microphones saw considerable development in the 1970s, taking on a form that is recognisable today. During the 1960s, the standard personal mic available to sound recordists and for OB sound operators was the RCA BK6B, and, from 1968 onwards, the AKG D109. First used at the BBC in 1957, the BK6B was a dynamic, or moving coil, mic that was specifically designed for capturing speech in film and television production. The BK6B (see Fig. 2) was considered to be "exceptionally small and light for a moving-coil microphone" (Manson, 1957. 3), despite measuring almost 7 cm long and 2.5cm wide, and requiring the user to wear a lanyard to suspend it from the neck. The BK6B had a relatively poor frequency response even for its era, dropping off dramatically both below 200 Hz and above 5000 Hz. However, used exclusively for capturing speech, it was deemed acceptable due its size and remained in use throughout much of the

1960s. In 1968, however, AKG released their first personal mic, the D109 (see Fig. 6). As with the BK6B, the D109 was a dynamic mic and was of considerable size, again necessitating the use of a lanyard. However, the D109 did offer some genuine improvements in performance with a frequency response that remained relatively flat up to 10Hz (AKG, 2017c).

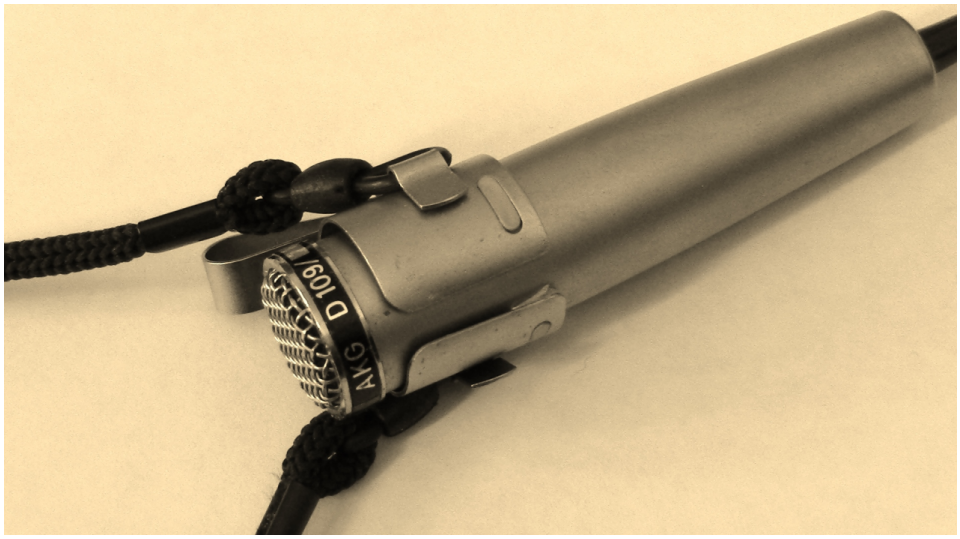

Fig. 6: AKG D109 (Photo: Mitchell, 2017)

Although the D109 offered a modest improvement over the BK6B, in 1969, Sony released the ECM 50, its first foray into personal mics (Sony, 2017). As part of its ECM series, first launched in 1960, the ECM 50 was not a dynamic mic, unlike the BK6B and D109. As an electret condenser mic, however, the ECM 50 was considerably smaller (see Fig. 7) and was considered the leading personal mic for over a decade. Writing in *Studio Sound* in 1980, Angus Robertson argued that "Sony has gained worldwide acceptance with its ECM 50 microphone (which is familiar to television viewers in every civilised country of the world)" (Robertson, 1980, 64)

> Writing in the same magazine some 15 years later, Dave Foister argued that, without “the ECM 50, the audio world would not be the same” (Foister, 1995, 44).

These comments made in the trade press are also reflected in the recollections of interviewees, with one OB sound supervisor interviewed stating:

> Sony ECM50s replaced all the big personal moving coil mics. The AKG D109 came along for a while as a personal mic, it was a bit smaller than the others, but then the Sony ECM 50 really became king (Sound Recordist 7)

Fig. 7: Sony ECM 50 microphone including battery pack and XLR connector (Photo: Vintage Tools, 2017)

Sony's ECM 50 went on to become the dominant personal mic for almost two decades, and the ECM range, including its personal mics, remains popular today. The ECM 50's status as an industry leader was earned due to a number of contributing factors. Significantly, the use of an electret condenser capsule, rather than the dynamic capsule used by the majority of its competitors, meant that the ECM50 was both extremely reliable and extremely effective in its performance. This increased performance, as well as its remarkably small size for its time, afforded sound operators greater freedom when attempting to disguise the microphone in clothing and costumes, something that had been a considerable problem when working with the BK6B or D109. Furthermore, the performance gain over existing dynamic personal mics also allowed for the ECM50 to be used to capture other sounds beyond speech. While previous personal mics were deemed adequate for the recording of speech alone, the ECM50 allowed for additional functions and found some use as an easily obscured effects mic.

In addition to personal mics, film sound secordists and OB sound crews would have been equipped with at least one AKG 451 effects mic. Originally released in 1969, and still on sale today in a modernised form, the 451 was a small diaphragm condenser mic (AKG, 2017b). Due to the unscrewable and replaceable capsule, which enabled the alteration of the polar pattern[3] (See Fig 8), the 451 was incredibly versatile, as different capsules could be used depending on the situation. These mics were commonly used with an omnidirectional capsule for seated interviews, as they could effectively capture both interviewer and interviewee. The 451 lacked the directionality to record the majority of dialogue but did find use for effects and was often used as a concealed mic when a boom could not get close enough without being in shot. However, due to its removable capsules, the 451 suffered issues when operating in the wet. The relatively loose connection created by the thread of the screw-in capsule made it

[3] The polar pattern refers to the sensitivity of a microphone based on the direction from which the sound arrives. The polar patterns most commonly used are cardioid, which is heart shaped (picking up most of its input from the front) and omnidirectional (picking up 360 degrees of sound). Another commonly used pattern is the figure-of-8, which, unsurprisingly, is sensitive to sound in an 8 shaped figure.

susceptible to moisture seeping in and distorting the sound. While this did limit the use of the 451 in many applications, it was, nonetheless, a popular and effective microphone for film recordists, studios, and OB sound crews.

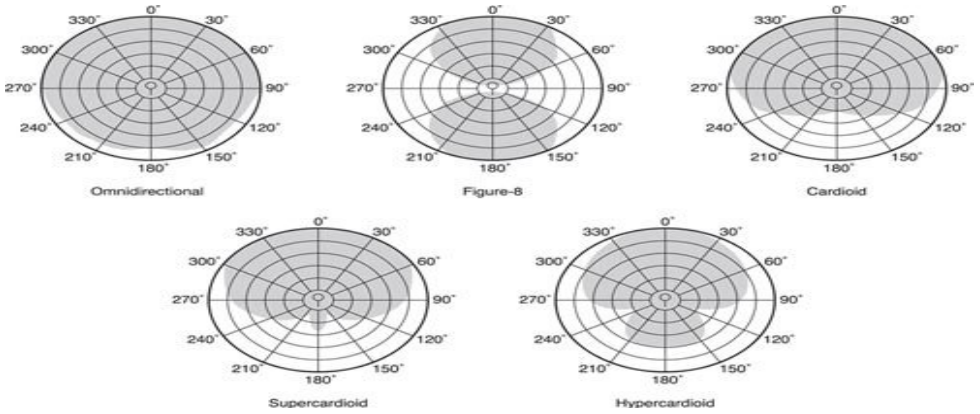

Fig. 8: Diagram displaying the sensitivity of differing polar patterns (Image: Gilchrest, 2017)

While OBs may have used much the same microphones as those used for film, they required more sound staff and a more complex set of working practices and relationships. While a significant operation, the processes for completing an OB were well-established and highly refined for those working in sound and, indeed, the wider production crew. Following the initial installation day, in which the "riggers" would position the bulk of the multicore cabling, the sound team would arrive on day two and begin their own sound-specific installation. Known as scanners, the OB mobile studios were contained in a cramped truck, within which the sound department would occupy its own small section, containing a mixing desk, a ¼ inch tape machine, outboard effects, and multiple patch bays (see Fig. 9).

Fig. 9: Sound compartment in 1970s colour OB truck (Picture: Adapt Project, 2016)

This sound section was lead by the senior member of the sound team, the sound supervisor. The second in command to the sound supervisor in the truck was the first sound assistant, while support outside of the truck was provided by the junior member of the sound crew, the second assistant.

The sound supervisor was responsible for the overall planning and delivery of the programme soundtrack, attending an initial planning meeting with other senior personnel, such as the director and senior camera operator, and responsible for liaison between the sound crew and other departments. Unlike the other members of the sound crew, sound supervisors were not assigned to a particular OB truck, but were specialists in their chosen field of production, such as golf or football. Before the shoot, the sound supervisor would draw up a plan for microphone installation and delegate its implementation to the assistants. The hierarchies and highly established working relationships within this team were well illustrated by the Adapt simulation of a 1970s OB. During this simulation, the contributing sound supervisor, sound assistant, and second assistant seamlessly reverted back to the workflows and hierarchies of their previous careers, despite the many years that had passed since their respective retirements. At the start of the installation day, the sound supervisor met with the sound assistant and second assistant in the sound area of the scanner to brief them:

sound supervisor*:* Alright if you could both come round to the back of the scanner [...] Okay, so basically it's going be a commentator on a lip mic, an effects mic, which I think we have an 816 for general effects. And we need a little mic behind the dartboard to pick up the darts going in. And a stick mic so if there is any in-vision stuff or interviews, we can deal with that. So that's four pairs on the multi-core, the 7 way cable is going in now.

s*ound assistant:* I think we have two multicores we can use.

sound supervisor*:* "Two multicores! What a luxury, ok then, one for programme and one for comms. Now, at the moment we don't have any cables, we're waiting for them to be rigged, so I'm going to refamiliarize myself with the desk. If you could take a few of the mics out [sound supervisor hands mics to the assistants] that can go outside, keep it all together, mind your step and I'll test the desk.

This briefing demonstrates not only the clear hierarchy amongst the sound crew but also the highly established nature of their practices. While the sound supervisor does outline an overall plan, they omit detailed instructions as they are unnecessary. Some of these generalised instructions, such as "one [multicore] for programme and one for comms", would have involved significant planning, rigging, and testing. However, short instructions could be given for these highly complex tasks due to the fact that the processes involved were well-established and the practices of the crew were well-refined.

Following the initial planning and briefing, the sound supervisor would set up the numerous input and outputs of the mixing desk. While this was not a uniform arrangement, general rule of thumb dictated that the first ten channels were taken up by commentary and other dialogue and known as green tracks, followed by five channels of effects mics known as red

tracks and a number of spare channels occupied by additional mics known as blue tracks. Finally a channel was dedicated to the tape machine, from which music and effects could be played in the mix. The actual layout of the tracks was set by the sound supervisor and depended on how the incoming channels were patched into the desk inputs. As shall be discussed in Chapter 4, the BBC was at the forefront of the development of production technologies for a significant period and, until the early 1970s, designed and built its own desks, foremost of which was the Type D. However, by the mid 1970s the BBC had begun to dispose of their in-house manufactured mixing desks, including the the Type D (see Fig. 9), and sought replacements from external companies. While, initially, Pye Ltd desks were used for OBs, by the end of the 1970s, Neve had become the manufacturer of choice, not only at the BBC but also in the wider industry. Lead by founder Rupert Neve, Cambridge-based company Neve became a significant organisation within sound equipment manufacture following their development of the world's first commercially produced transistorised mixing console in 1964. The launch of their 1073 pre-amps in 1970 further entrenched their reputation as a leading manufacturer, with the model becoming the benchmark for all subsequent pre-amp design and remaining sought after today.

Regardless of the manufacturer, these desks were all analogue mono desks with, usually, 24 available channels. While an entire programme would usually be recorded on 24 channels, it was not unheard of for a small external six-track mixer, with a single channel mono output, to be used to expand the capacity of the main mixing desk. The following decades saw significant developments in mixing desk technologies, most notably the integration of automation and digitally assignable desks (see pages 191-195). However, due to the live nature of OBs, the advantages of these desks were mainly found in the flexibility of their installation and setup, rather than their actual operation during transmission or recording. When mixing sound live, or as live, the sound supervisor would have had to manually operate all tracks simultaneously, following the unfolding action, regardless of the affordances of the desk.

During the rehearsals and subsequent broadcast, the focus of the sound supervisor would be on performing the live mix. Skilfully blending the multiple elements of the sound

track, the sound supervisor would have to predict and react to the action as it unfolded in order to maintain a consistent and balanced soundtrack. This ability to follow and anticipate the event being covered was crucial, as a sudden spike in sound levels, such as that caused by crowd reaction, not only sounded unpleasant but also had the potential to cause a host of technical issues, such as distortion. Consistent failure to predict peaks, and adjust the levels appropriately, could lead to a programme being taken off air if it breached strict broadcast volume level rules, while, in extreme cases, exceptionally high peaks could blow the transistors in the OB truck. Therefore, the ability to effectively manage a mix and react appropriately to the unfolding live events was at the heart of the sound supervisor's work.

The role of the sound assistant was twofold. During shooting they would assist the sound supervisor with the task of mixing, often controlling a number of faders if the programme required a high number of tracks. The sound assistant was also tasked with a number of operations, including cueing and playing-in sounds or music from ¼ inch tape and operating jack fields. However, a significant element of the sound assistant's work came before any rehearsals or live shooting had even taken place. During the setup phase, the sound assistant was responsible for planning and implementing all local communications and talkback for the entire outside broadcast. These processes were of the utmost importance, as they enabled separate departments to communicate with one another and, crucially, allowed the director to orchestrate the numerous distinct elements that make up an OB into a cohesive operation. Working off the large multicore cables installed by the riggers, the sound assistant would provide each required destination with the necessary "comms lines". Destinations, such as the commentary box, camera positions, and studio area, would need to be provided with a number of separate lines in order to operate efficiently. An initial feed to the sound output, known as a music line, was provided, along with a talkback line, which allowed the scanner to communicate with the destination, while a further reverse talkback line, allowed the destination to communicate back to the scanner. Implementing this complex communication system, often in less than ideal conditions, took considerable planning and skill to successfully complete. As one sound supervisor, who had worked his way through the second assistant and assistant ranks, describes:

> Rigging the comms was often far more complex than the actual sound mix, people would often ask why we had so many outputs, well the reason was for all the comms (Sound Supervisor 3).

Another stated:

> I cannot emphasise enough that in sound operations, communications ranked equal with audio in making productions run smoothly. [Because of] The operational nature of the overall job and since the inputs and outputs to the communications systems were often in the domain of the sound operators, the logical conclusion was drawn that sound should devise and deliver both communications and audio (Sound Supervisor 4).

As an sound assistant simply adds:

> A huge part of our job was to make sure everyone heard everyone else! (OB Sound Assistant 2).

Assisting the sound supervisor and assistant from outside the truck was the job of the junior member of the crew, known as the second assistant. While the initial cabling was set up by riggers a day before the sound crew arrived on location, second assistants were responsible for setting up microphones and connecting them to the web of existing multicore cables. They would also play a crucial role in testing and fault-finding after the initial microphone installation, testing individual microphones while the sound supervisor checked for a signal at the relevant desk input in the scanner. Depending on the outcome of these tests, the second assistant, working alongside the riggers, would either find and replace the faulty cable or begin positioning microphones and securing cables to be used for the duration of the shoot. During

the shoot, the second assistant would be armed with back-up microphones, ready to act should anything fail outside of the truck.

Unsurprisingly for this type of production, managing the vast and complex technologies, avoiding failures, and having adequate contingencies were the predominant concerns of those working on OB sound. In the era of analogue technologies, failures were commonplace, meaning that the sound crew simply could not rely on their equipment to work faultlessly throughout a shoot. As such, planning around these failures by ensuring sufficient backups were in place, as well as staying on top of general maintenance, was crucial to the successful operation of a programme's sound. Added to this technical frailty were the inherent pressure of live, or as-live, television and the numerous difficulties of working on location, often in less than ideal conditions. For outside broadcast crews, major sporting events, royal appearances, political summits and a host of other significant public events were considered 'bread and butter' work. Due to the nature of such events, the ability to capture good quality sound at the first and only attempt was essential. Discussing their approach to work and priorities when on location, multiple interviewees pointed to the importance of managing their equipment and building-in sufficient space to absorb faults within their setup, as one sound supervisor stated:

> In the days of type 2 scanners the focus was on the engineering and making things work. The technology at the time just could not be relied upon, so having adequate backs ups, and completing adequate tests, were always the key priority for the sound department. Other considerations included the weather: all kit was susceptible to damp, particularly connectors on cables. Half of the time was spent making things work and fault-finding (Sound Supervisor 5).

A sound assistant adds to this account, pointing to the importance of expecting and building equipment failures into initial work plans:

> You always had a back-up mic to hand in case something went wrong, and if it did, you could switch to it, it might mean a few seconds of no sound but nothing that audiences would really complain about. You never left anything to chance. If you were doing something like a royal wedding you had 4 back-ups! [...] Generally, you'd build in a back up, so if you set up 32 lines, you'd be happy if 25 worked. A bit like cameras, they might have 5 cameras set up but they'd be happy if only 4 worked (Sound Assistant 3).

Another sound supervisor simply stated that his biggest concern was "well, that everything actually worked!"

While the majority of interviewees stressed the overriding importance of technical proficiency, there were undoubtedly moments of creativity and experimentation amongst their routine practices. While the fundamentals of microphone placement were generally formulaic, multiple interviewees discussed a number of incidents in which they broke this formula, going to great lengths in the pursuit of more complex and interesting sounds. As one sound supervisor stated:

> The exec producer of cricket came to us and said “Can we put a radio mic in the stump?” This is before they had cameras in the stumps, before all the miniaturization and we decided no we couldn't get a mic small enough [to place in the stump]. So [...] at the BBC sports club ground at Motspur Park, we proved the case of burying radio mics. And it was used and, at his request, having seen the test that we showed him. [...] It did work but, as I remember, because it was rather damp at the beginning [it was not high quality], but, when it dried out it worked quite well [...] and then all the miniaturization came along and its been all improved, so it’s no longer required (Sound Supervisor 6).

Another sound supervisor discussed how, as a newly recruited second assistant, he was tasked with suspending a microphone underground in order to achieve the desired bass-heavy tone of a firework display:

> There was a lot of burying mics here and there. One of my first jobs was doing this international firework competition at Windsor Castle. And the sound supervisor said to me “I want a 1 metre square hole, cover the top with some bits of wood and put the turf back once you’ve suspended a mic in the middle”. So I went off to the riggers and borrowed a spade and started digging. It actually sounded quite good, it gave this wonderful bass tone to the fireworks (OB Sound Supervisor 2).

When discussing microphone placement on darts coverage, one sound supervisor discussed the tactic of placing a small personal mic behind the dart board, in an effort to acquire more varied sounds to accompany the visuals:

> When doing darts, you'd always hide a little Sony ECM 50 directly behind the dart board. It gives you a nice thump as the darts hit (Sound Supervisor 7).

Yet another sound assistant spoke of the creativity and tacit knowledge applied in order to effectively ensure the best possible results. Although not directly addressing the creative acquisition of sound, this sound assistant does illustrate the flexibility and inventiveness sound personnel were required to demonstrate in order to deal with the challenging aspects of outside broadcasting:

> There lots of tricks, for instance at football, it's was standard to rig some mics in the stands, usually hung from the ceiling. You'd always put a couple of dummy mics in some very visible places as people seemed to enjoy swearing into them. That way they tended to not notice the mics you were actually using (OB Sound Assistant 4).

Clearly, for those working on OB sound, maintaining and operating extremely complex and unreliable equipment in the pressurised environment of live television took up the majority of their time and shaped their working practices. However, this did not mean that their role was devoid of artistic sensitivity. Although restricted by the limitations of analogue technologies, creativity and experimentation certainly existed in practices that were, to an extent, shielded from the inherent pressures of OB production. Microphone placement was planned and implemented on the setup day, before the demands of the live operation reached their peak. This period of relative calm gave an opportunity for sound supervisors and their teams to experiment with non-conventional mic placements in an effort to make an artistic contribution to the programme's soundtrack. Undoubtedly, such programmes as darts or cricket coverage would have been perfectly adequate for broadcast without the added sound effects that these processes provided. However, interviewees clearly identify this experimentation and the application of tacit knowledge as an important aspect of their professional practice. While

conquering the vast technical challenge of OB sound was the overriding priority for OB sound personnel, they still exploited opportunities to be creative where they could find them.

For studio based productions, sound operated in a similar way to OBs, but with a few notable exceptions. Clearly, the permanence of the studio infrastructure removed a significant number of the anxieties surrounding equipment failure that existed in OB. Furthermore, studios were designed to silence outside sounds and were acoustically treated to minimise reverberations, therefore creating a 'dead' sound within them. This clearly helped the sound crews to acquire clear intelligible dialogue, as they were not at the mercy of external factors, such as wind or traffic noise, which commonly impeded the work of OB sound crews. However, the most significant difference between studio and OB sound was in the makeup of the sound crew. The sound supervisor and a sound assistant would occupy the sound control room, mirroring the arrangement on OBs, and would have been responsible for the planning and preparation of the mixing desk and microphone placement, although, on the studio floor, the sound crew also comprised at least one designated 'boom op'. Considerable pieces of equipment, the microphone booms used in studio production were not the basic 'fishpole' style designs used by location film sound recordists and, occasionally, OB crews. Mounted on wheels, these large booms comprised a long boom pole mounted on an upright support with a counterweight on the non-working end. Often, a studio boom featured a seat from which the operator controlled the boom and which could be mounted on tracks to enable a controlled panning motion. These booms were designed to allow smooth movement on both horizontal and vertical planes as well being able to both extended out and retracted back in. This system meant that booms could be much longer than would be physically manageable with a hand-held 'fishpole' boom. The infrastructure of studio-based production undoubtedly removed many of the hurdles experienced by those working on locations. The controlled environment and large fixed technologies, unavailable to those working on location, enabled the studio-based sound crew to more effectively acquire clear intelligible dialogue without the distractions and obstacles of external factors and unreliable technologies.

While there were, and still are, numerous differences of varying significance that distinguish these 'production sound' roles from one another, there is a common characteristic found within all of these roles - the importance of communication and interpersonal skills. Television production is inherently an exercise in collaboration between a number of groups of individuals with differing practices and distinct objectives. Due to the work involved in sound acquisition (using microphones on long poles, hiding microphone in actors' costumes, and attempting to get as close to the action as possible), sound operators would regularly be required to work closely and collaboratively with numerous departments. The practices of lighting departments, costume departments, and camera operators would regularly be in conflict with the requirements of the sound department. As a result, a sound recordist's ability to work closely and collaboratively with these other production professionals, being able to work out mutually satisfactory solutions, was a significant factor in their daily work. Many interviewees spoke of their need for good interpersonal skills and to maintain good working relationships in order to effectively complete their work. One studio sound supervisor spoke specifically about maintaining good relationships with the costume department, which enabled him to more effectively use personal mics hidden within the actors' costumes:

> Oh there had to be a lot of teamwork and compromise. Some actors and costume designers might sort of say "Oh I've got to have this costume!" but there weren't too many. Most you managed to have a good working relationship with. In fact there were some really good people in make up who would help conceal your transmitter in a wig! Certainly when the new mics came in, not the lanyard ones, they'd help conceal the capsule just behind the ear (Sound Supervisor 6).

One sound recordist also discussed the application of interpersonal skills and compromise when on location so as to better achieve his goal of recording good quality sound. In relation to working with lighting technicians, or 'sparks', he states:

> Well the main concern was not recording the sound you don't want. You know, trying to keep things quiet, convincing the sparks to move their generator a distance a way which might mean running out a bit more heavy cable out for them and that sort of thing (Sound Recordist 7).

The issue of working collaboratively with the lighting department was also mentioned by an OB sound supervisor. Discussing a particularly challenging set, he points to the compromise brokered between himself and the lighting technician, in order to effectively achieve the goals of both departments:

> You just had to work very much as a team. To give you a concrete example, we once did a thing where the set was entirely circular, 360 degrees of plywood flats, with the cameras shooting through a little window. So you could hardly get any lighting in this. So, in the end we came to an arrangement that he would clamp lights to the top of the scenery so that his key lights would be under my boom and not over it and so no shadows were cast. It meant I couldn’t get as close with the boom but we had to totally think outside the box. It did work (Sound Supervisor 8).

One documentary sound recordist describes generally what was expected of a sound recordist, beyond their core technical skills:

> We were there to make films and we were interested in the end product. You had to work very much as a team. As a sound recordist you had to be lots of things. You had to drive a lot and travel a lot, you had to be good company. You had to get on well with artists and actors and your colleagues. You had to be sociable. That was as much a part of the job as anything else, the sound recording bit could actually be quite a small consideration (Sound Recordist 6).

Clearly, in an era of technological limitations and unreliability, maintaining good relationships and working as part of the wider production team were critical to the successful completion of a production sound operator's work. Despite the many differences between production sound roles, interviewees continuously cited this as fundamental to their job and inherent to the wider ethos of their working environment.

Post-Production

Postproduction sound is the other major aspect of television sound and comprised the second, smaller, group of professionals of television sound operators. With the exception of live production and news programming, almost all television content received some form of post-production sound editing; however, this varied, and still does vary, wildly, depending on the type and status of a particular programme. Post-production sound crews are tasked with taking the separate and distinct recordings captured during production and blending them into a coherent and consistent soundtrack. Mixing the location sounds with additional effects and music, post-production sound crews aim not only to create a technically efficient mix but also to add to the construction of a programme's narrative.

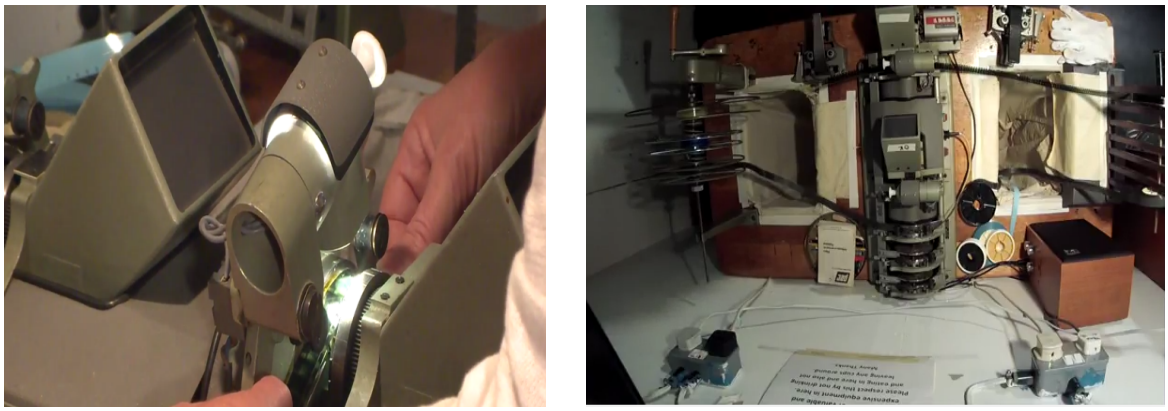

Fig. 10: An aerial view of 16mm PicSync machine and a close-up of operation. (Photo: Adapt Project, 2014)

Until the early 1990s, almost all dubbing was carried out using magnetic film stock and analogue mixing desks. The first step in the process, once an edit had been assembled, was the track lay.

Track lays were constructed by physically cutting and splicing 16mm magnetic film stock. This task was both time-consuming and inflexible. Making changes to an edit would require physically re-cutting and arranging the film tracks. Figure 10 shows the complex and labour intensive PicSync machine used by editors and track-layers to sync magnetic film stock to the image. Consequently, significant consideration went into the original assembly and edits were avoided unless completely necessary. Once the track lay was finalised, it would be transferred to the dubbing theatre to be mixed by a separate team of operators.

In the era of analogue mixing, this team of operators included the dubbing mixer, who was the senior member of the post-production team, an assistant, known as a *gram op*, and a second assistant, who was the junior member of the team. As the senior member of the team, the dubbing mixer was responsible for leading all dubbing sessions. This would involve meeting and discussing the overall vision for the sound with senior members of the production team. Correspondingly, they would be responsible for planning the sessions and technical specifications based on these discussions. During the dub, they would have overall control of the mixing and be responsible for operating the desk.

The first assistant, or gram op, would assist the dubbing mixer in a number of ways. Firstly, they would be tasked with assisting in the significant setup procedure. Analogue desks and recording both from and to magnetic film stock required a vast amount of planning and rigging. Due to the nature of analogue desks, each sound source required a distinct channel through the desk, which had to be manually routed using a patch bay[4]. When discussing the setup procedures of analogue desks, one dubbing mixer stated:

> It was much more technical. With analogue desks like the Neve we had, so much more planning had to go into things and all the channels had to be connected up using patch bay. You actually physically had to rig, the assistant would help the supervisor rig. You'd have a rig day and would actually be physically plugging jacks into the wall for what you needed to go into the desk, and out of the desk, and to the tape machines and so on (Dubbing mixer 1).

As shall be discussed in Chapter 7 (see pages 186 -195), developments in mixing desk technology throughout the 1980s and 1990s would significantly reduce the time spent on these tasks, as digital desks massively increased the speed and flexibility of working. However, when working with analogue desks and recording to magnetic film, these tasks made up a significant part of the working practices of both the dubbing mixer and the gram op. During the dub, the gram op had a number of responsibilities. Primarily, they would be tasked with playing-in external sounds, such as effects and music, into the desk in real time. Originally played-in from gramophone discs (thus giving the title gram op) and, subsequently, tape, these sounds had to be cued and then played-in, known as a drop-in, at precisely the correct time so as to fit with the image. There was no way of these sounds being automatically dropped-in, meaning that the gram op operated "as live", manually starting and fading-up the

[4] A patch bay is a panel of organised input and output sockets that can be quickly connected via a standard cable type, normally a ¼ inch jack cable roughly 1.5 feet in length. Patch bays allow for quick routing of audio paths while standardising connectors and cables, and are used for a number of tasks, such as using outboard equipment or monitoring.

sounds as necessary. Failure to drop-in such sounds at the correct time and with sufficient subtlety could result in effects starting either out of synch with the images or midway through the required sound clip. This creates audible and unwanted jumps and clips in the soundtrack. As shall be discussed below, as the work of the dubbing mixer was incredibly labour intensive and stressful, adding these tasks to their already full workload would have made their work practically impossible. As such, the work of the gram op was vital to the effective production of a clear and refined mix. A further responsibility of the gram op was to assist with mixing. When mixing with non-automated desks, all faders had to be operated and mixed simultaneously in real time. During particularly complex sections, the gram op may have been tasked with mixing a number of faders alongside the dubbing mixer.

As well as general assistance with rigging and operation, the junior member of the team, the second assistant, had a significant role to play. During the dub process, the second assistant would be responsible for monitoring the mix output from the desk. Particularly focusing on errors such as missed cues and harsh drop-ins, the second assistant was tasked with flagging the errors missed by their colleagues in the heat of the 'as live' mix. As will be shown, mixing in the analogue era was a fraught and immensely stressful task. Consequently, the role of the second assistant in monitoring the results of this process when their superiors were very busy was paramount to maintaining the quality of the crew's output.

As with their colleagues in production sound, considerable concern, and a significant amount of labour, was put into managing the available technologies and working against the limitations imposed upon them. Foremost of these concerns was the necessity to mix 'as live'. As discussed earlier in relation to OB sound mixing desks, by the mid 1970s, third party manufacturers began supplying the BBC with mixing desks, as the corporation ceased its development of in-house desks. (see Fig. 11).

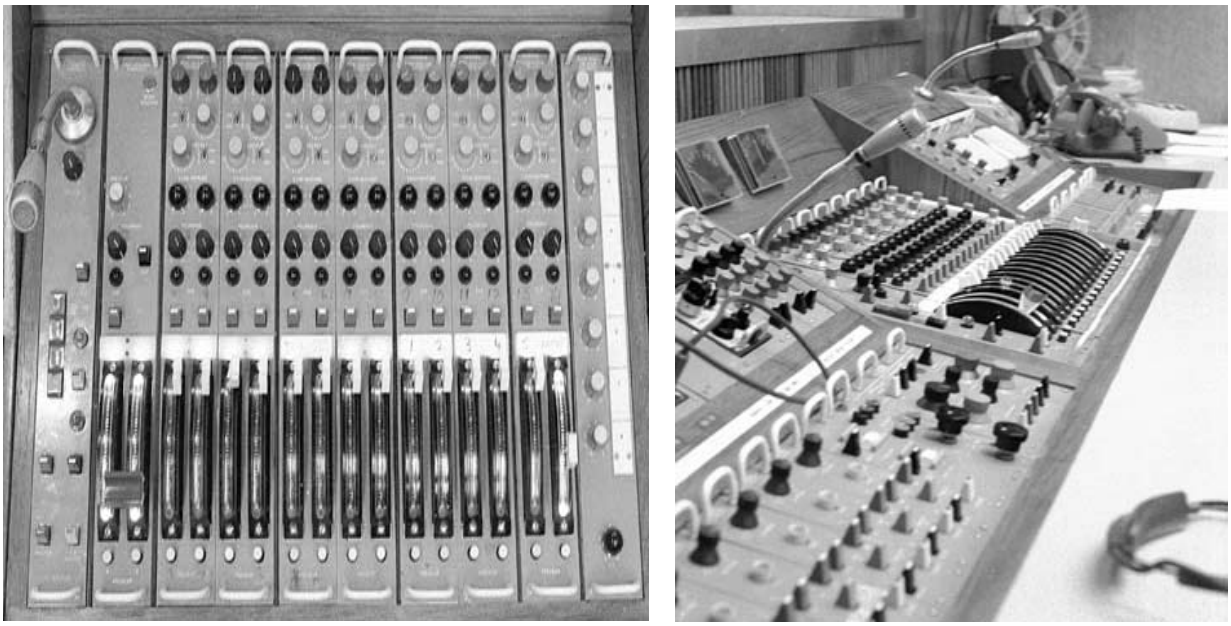

Fig. 11: BBC Type D mixing desk fader panel and wider view of entire desk (Photo: ORBEM)

Neve was the leading manufacturer for post-production sound and by the end of the 1970s was the standard desk used in post-production, particularly its 8058 model of desk. The Neve desks of this time were, of course, fully analogue with no automation or digital routing. However, as discussed earlier, Neve desks gained a significant reputation for their sound quality and performance.

Before fader automation became commonplace in the 1980s, all mixing had to be undertaken 'as live' with the dubbing mixer, following the images and altering levels in real time. If a mistake was made, the tapes would be rewound and the mix, or premix, started again from the beginning. As there was no option to store or preserve work completed up to that point, any mistakes would result in restarting from the beginning. Due to the inability to save work in progress, analogue mixing was a highly pressured and extremely stressful task. Interviewees consistently emphasised the stress of working with these tools and the mental agility required by mixing in the days of non-automated desks. For these operators, the overriding focus of their work was to efficiently manage the equipment, ensuring that the correct faders and knobs were adjusted at precisely the correct time so as to avoid costly errors. Mixing 'as live' meant that errors that would be considered trivial on newer iterations of mixing desk could potentially lead to an entire mix grinding to a halt. Under such conditions, pres-

sure could quickly mount, as the dubbing mixer would eventually have to perform an error-free run-through in order for the mix to be completed. One senior dubbing mixer discussed this aspect of their work when using analogue desks:

> When mixing on a totally manual desk, you're very wary of where you're putting your faders because if you make a mistake you have to go back and put them back, otherwise you can't drop-in to record, you have to be able to match not only levels but your EQs and your pans. The amount of mental brain processing going on was massive (Dubbing Mixer 2).

Another dubbing mixer also pointed this out as a significant aspect of their work when using desks with no automation:

> The old way of mixing is a bit of a performance really in the theatrical sense of the word, because you are teaching your fingers to carry out a sequence of actions in response to numbers and actions on screen and, as soon as you've got it right, you have to forget all that and move onto the next (Dubbing Mixer 3).

As will be shown in Chapter 7, the introduction of fader automation meant a shift away from mixing, as live and freed dubbing mixers from the considerable stress and anxiety of mixing in this way. However, what is clear is that, in the era of non-automated desks, the task of mixing all channels simultaneously while achieving a perfect run through was a considerable aspect of the dubbing mixer's work.

A further limitation when mixing with magnetic film was the number of available tracks. Track counts were particularly low even for the most prestigious of programmes, with the standard maximum number of tracks usable at any one time being 12. While dubbing mixers and their teams could get around this limitation through the practice of premixing, this had a number of significant disadvantages. In short, premixing was the practice of mixing a

group of sounds, such as dialogue or effects, separately from all other sounds and, then, recording this group of sounds to tape, known as completing 'a pass'. Once a particular pass had been recorded, the dubbing mixer could then start again from the beginning, focusing on a separate group of sounds to be subsequently committed to tape on top of the existing recorded sounds. Not only did this help to free up available tracks, but it also aided in mitigating the aforementioned stresses of 'as live' mixing. However, this created a number of practical issues. Firstly, due to the nature of analogue recording, when a sound was copied from one stock to another, as happens when recording a premix, the sound was subject to generational degradation. After a significant number of of generations had been copied, the sound being recorded became noisy and distorted. If too many premixes were attempted, the noise would become significant and jeopardise the overall mix. As a result, mixing was a fine balance between creating space in which to mix effectively while avoiding multi-generational degradation.

One dubbing mixer, who won a Bafta Award for his dubbing of *Edge of Darkness (1985)*, spoke about the need for premixing due to the limitations on track counts:

> Well what you'd need, or what you'd like, was half a dozen tracks for dialogues. Backgrounds you'd probably have another half a dozen and effects maybe another half a dozen. The upshot to that is you have to make premixes because you just don't have that many film tracks available. So you'd end up with 4 or 5 premixes plus music to a final mix (Dubbing Mixer 3).

Another dubbing mixer again pointed to the necessity of premixing in order to ensure an adequate number of available tracks, also bringing up the inherent risk of premixing:

> You could in effect create more tracks than you actually had. So let's say you could run 8 sources into your desk and record that down mag and that would be your dialogue premix. Then you would go back and play your dialogue premix but add in effects and then that would be your effects pass and so you could build up a mix bigger than you could actually handle… That of course was made everything noisy because everything was a pass (Dubbing Mixer 7).

A dubbing mixer at a highly regarded post production house also brought up the issue of generational degradation when working with analogue film stock:

It was very noisy, you have to remember that you transferred it from ¼ inch to full mag probably copied some tracks down to single track on a separate mag film (such as effects and dialogue etc) and then copied that to a master for broadcasting or for transfer onto tape for broadcasting, so by the end you could be 4 or 5 generations down so the quality wasn't great (Dubbing Mixer 5).

Another Bafta award-winning dubbing mixer, known for their work on natural history programming, also spoke of this issue. Directly discussing his later work on documentary *Trials of Life* (1990), he states that mixing with higher numbers of tracks only became feasible when noise reduction technology was introduced, therefore mitigating the impact of premixing:

> The track count of Trials of Life for example, we had four atmos tracks and 6 effects tracks, and that was big natural history show. So it was all built around premixing. At the end we managed to have higher track counts, but only because we got Dolby Noise Reduction, and that meant that this hiss didn't get so horrendous that you couldn't use the sound (Dubbing Mixer 6).

Premixing also created a second issue for the post production sound team. As discussed above, the laborious process of cutting and splicing tape and syncing this to picture when track laying meant that changing an edit was a difficult and time consuming task. As a result of the limitations of this machine and the practices it necessitated, decisions on the track lay were not taken lightly and changes had to be thoroughly considered and justified.

Premixing created a very similar issue for the dubbing mixer and their assistants. Once a premix had been committed to tape, making changes to a premix was incredibly time consuming, as it would require re-recording the premix in question. If more than one premix had been committed to tape, then this process was complicated even further by the fact that it was impossible to separate individual premixes once recorded on the same medium. One dubbing mixer spoke directly of this problem when premixing:

> Back in the day, we were limited to 8 or 12 tracks, obviously we could condense that down to have 8 tracks of dialogue or effects recorded to just one track, but that created issues if someone didn't like an effect you'd used [as] it was already mixed in with all the other effects on that track [...] you'd end up having to try and quickly do cross fades from another effects track and hope it didn't disturb other effects (Dubbing Mixer 7).

Another dubbing mixer also spoke of the difficulties of changing premixes. Referring to the 'painful decision' to edit premixes, he states:

> Suddenly you might think actually 'I've not judged how this works together, they don't interact in the way I thought they would' and so you'd have to adjust the premix. That means going back, replugging up your analogue mixing desk and your jack fields. Each time you had to make a painful decision to go back to a premix stage, it might be half an hour of patching stuff and loading up sounds again. So, it was so long winded and laborious (Dubbing Mixer 6).

Yet another dubbing mixer also discussed this issues:

> Decisions had to be made earlier in the process. If we were premixing, it took a lot of time to undo premixes. You had to make your decisions and stick with them as you went along, because they were so hard to undo (Dubbing Mixer 8).

Clearly, post-production sound operators share the experience of anxiety and frustration felt by production sound personnel due to the limitations of their professional tools. However, this is not the only shared experience that affected those in both production sound and post-production sound. Much like those of their colleagues who worked on location, interviewees consistently cite collaboration and teamwork as being a pillar of their working practices. The intimate working relationship of the three person crew undoubtedly helped to foster an environment of collaboration. Furthermore, unlike in production sound, post-production crews were not as exposed to the outside influences of other departments with conflicting practices. Whilst post-production sound crews did work closely with editors, the inflexible nature of editing film often meant that the edit the post-production sound crew received was relatively finalised and so unlikely to change drastically. Within this relatively sheltered environment, post-production sound crews felt a genuine sense of team spirit, in which all members could contribute. One dubbing mixer recalled her time as an assistant, and discussed her experience of having genuine input, even in a junior role:

> It was a real team effort. As an assistant, you'd be watching and making sure [things went well]. You might say 'oh you've missed that, can we just go back'. You were another pair of eyes and ears and you were all working towards the same end of making a brilliant programme. So, my opinion was valid even as an assistant (Dubbing Mixer 1).

A further dubbing mixer discussed the team dynamic when working with analogue equipment at a large vertically integrated broadcaster:

> You had a dubbing mixer that was the lead person, then you would have an assistant gram op that sit beside the main mixer and they would drop in sounds. Then there was a further assistant who would monitor all the drop-ins, their job was to make sure when the mixer hit the record button that the drop in was smooth [...] And you all tried to feed into the creative discussions about things. There was great symbiosis between all the roles. Everybody brings something different. You've got to be prepared because you don't know where the good ideas will come from. Obviously you're the lead there and you hope most of them come from you but you've got to be open to input from anywhere. It's about making something as good as it can possibly be (Dubbing Mixer 2).

Another dubbing mixer spoke of the relationship between those working in post-production sound and their colleagues working in wider areas of production:

> There was more attendance from producers in those days [...] Editors would also sit in on the mix. It was a team effort. There were, and still are difficult people to deal with but it was definitely a team effort and a meeting of creative minds (Dubbing mixer 6).

Chapter 7 will discuss in detail numerous technological developments that have facilitated the reduction in personnel allocated to these tasks and the resulting isolation of many now working as dubbing mixers. However, what is clear from the testimonies of those working at vertically integrated broadcasters using labour intensive analogue equipment is that teamwork, collaboration, and personal skill was an inherent characteristic of post-production sound.

As has been shown throughout this chapter, the practices, expectations, and priorities of those working in this era are shaped by a number of common experiences. Those in production and post-production roles state that managing technologies and working around the limitations of these technologies was a primary concern during this era. Furthermore, their working environment was clearly characterised by relationships that required collaboration and compromise. As has been shown, the teams of professionals that make up television sound operators comprise many distinct roles with a range of different objectives and practices. Not only did these professionals have to work efficiently together but also, as a team, they had to fit into the wider relationships and hierarchy of the entire crew. As the rest of this thesis will show, these groups of professionals have seen their practices and wider working lives fundamentally change as a result of technological and industrial shifts. Almost all aspects of their working lives have been affected, from the way they are trained to the way they view and promote their work. However, to illustrate these points, it is important that the practices and working arrangements of the previous historical period of relative stability are understood. By detailing some of the practices, technologies, and working arrangements listed above, this chapter aims to have established a starting point from which the research presented here can be interpreted.

Training

The previous chapter introduced a number of the technologies, practices and working relationships typical of sound production at vertically integrated broadcasters. As the following chapters will show, many of the practices and cultures of this group of professionals have been fundamentally altered due to numerous industrial, technological, and social factors. However, before detailing these in-work practices and cultures, attention shall be given to the training process through which sound operators gain their skills and seek future employment. As this chapter will discuss, training is a process that has itself seen significant adaptation and reorganisation throughout the period with which this research is concerned.

Traditionally, sound operators in British television production were trained in-house at vertically integrated broadcasters, which provided bespoke and exhaustive training. This training provided new industry entrants with not only a thorough knowledge of their own distinct practices but also an understanding of the practices of other production personnel and the wider context in which productions take place. Training courses were competitive, intense, and stringent in their assessment and aimed to provide new industry entrants with the skills and knowledge necessary to work with the existing crews both at the and in the wider industry. However, in the latter part of the Twentieth Century, coinciding industrial events fundamentally changed the ways in which new sound operators enter the industry and receive training. As vertically integrated broadcasters move themselves towards the publisher-broadcaster model, they have relieved themselves of the responsibility to recruit and train below-the-line staff and no longer comprise the industry's main training hub. During this period, the opening up of higher education (HE) in Britain quickened in pace and new institutions quickly expanded into fields such as media production, filling the void in training provision created by the broadcasters' withdrawal. Subsequently, the majority of new sound operators entering into the television production industry have been trained at universities rather than broadcasters. Furthermore, outside of the training provided by their universities, new industry entrants are now tasked with arranging and paying for their own job-specific training, usually in the form of unpaid work experience in an industry increasingly dominated by freelancers and casual employment.

This chapter argues that the shifting form of training provided to sound operators has significantly altered the way in which they approach, conduct, and think about their work. As the organisation and provision of training has changed, so too has the way in which sound operators are inducted into the industry. In the era of vertical integration, new entrants were brought into an environment with a shared culture and a highly entrenched set practices and codes. As the responsibility for the provision of training has shifted from broadcasters to universities, the fragmentation of these new providers and the variation in the training they provide have resulted in sound operators being trained in a manner that is no longer integrated wholesale into the industrial environment in which they will work. In addition to this issue, new industry entrants are now provided a significantly different set of skills and practices with which to build their future careers. The training provided by vertically integrated broadcasters gave significance to technical and engineering-based skills, such as the maintenance and adaptation of professional technologies. As shall be shown, universities have struggled to strategise the implementation of training, with debates surrounding the prioritisation of theory over practice remaining ongoing. As a result, few universities attribute such significance to the technical aspects of sound production which once dominated operator training. As a result, training must be seen as a significant contributor to the changing practices and identities present in television sound personnel. As shall be discussed in subsequent chapters, sound operators have experienced significant upheaval to numerous aspects of their working lives, including the way they interact with their professional tools, the way they interact with their production colleagues, and the ways they identify and project their work. Clearly, the way in which sound operators are trained must be viewed as at least partially shaping these experiences.

This chapter will start by discussing the training of sound operators in the era of vertically integrated broadcasters. Attention shall be paid to how this training aimed to cultivate a shared set of practices and entrenched working culture amongst all technical roles. Further analysis shall focus on the criteria, aims, and methods used within this training environment

in order to arm junior sound operators with a foundation of technical knowledge from which to develop their careers and professional practices. Following this, the analysis shall turn to the migration of training from vertically integrated broadcasters to universities. This section will discuss some of the many factors behind this migration and discuss the accounts and concerns expressed both by interviewees and in the wider industry press. Finally, this chapter will conclude by contextualising these accounts in the wider developments of HE in Britain.

The Era of In-House Training

In her work on training and skills development in British television, Stoyanova (2009) has argued that when television production was dominated by vertically integrated broadcasters, entry into the industry was more structured, accessible, and clearly defined than in the free-lance environment that followed. These organisations provided extensive training and opportunities for career progression in an effort to nurture talent from within before recruiting externally (Stoyanova, 2009; Pawley, 1972). Stoyanova stated that employees hired "in any capacity [by a broadcaster] entered onto a path which will likely lead into television [production]" (Stoyanova, 2009, 152).

In the era of vertically integrated broadcasters, the BBC was regarded by those within the industry as its leading training and educational facility (Briggs, 1995; Ursell, 2000a; Langham, 1996, 79) and possessed considerable resources dedicated to training. While some larger ITV franchises, such as Granada and Thames, also ran training schemes, it was widely known that ITV companies actively poached BBC trained staff, by means of increased salary offers, due to the quality of training received at the BBC (Briggs, 1995; Ursell, 2000a; Langham, 1996, 79). A writer for *Line Up* magazine described the BBC Engineering department's training ethos as:

> stamped all over broadcasting. [The BBC] has coloured the development of technicians over the years,and will continue to do so until the majority have retired (Woolf, 2006, 26).

Interviewees for this research overwhelmingly entered the industry via the BBC in the early 1960s to mid-1970s. The beginning of this period marks a significant point of expansion and transformation for the BBC and, consequently, its staffing and recruitment processes. Having lost a great number of its engineering staff to the armed forces during World War Two and having shelved television broadcasting during this period, the BBC had, by the 1960s, come out of its post-war reconstruction and entered into the "years of expansion" (Briggs, 1970; Pawley, 1972). BBC Two was soon to be launched, and the BBC and ITA were in the process of trialling and negotiating a number of systems for colour television (Pawley, 1972; Briggs, 1995; Sendall, 1982). The recruitment of new staff at the BBC rapidly increased during this period, with over 1500 new employees passing through the Wood Norton training centre, up from 700 in 1956. Furthermore, the background and experience of these new entrants changed significantly over this period. As national service was wound down in Britain, the BBC was increasingly recruited school leavers, rather than those leaving the armed forces or experienced engineers and, by 1963, school leavers made up the majority of new entrants to Wood Norton (Pawley, 1972).

The standard route into an operational role in sound was via entry onto the *Technical Operators* (TO) course. TOs made up the majority of below-the-line production roles, including camera, lighting, and sound operators. Entry onto the courses was competitive, with one former BBC manager stating that operational vacancies had been known to receive more than 1,000 applicants and that jobs at the BBC were widely viewed as 'jobs for life'. Prospective entrants onto TO courses were required to have A Levels in both maths and physics and the course itself was designed to be both intense and highly competitive. Throughout the course, entrants were tested weekly on different topics of study, with the 14 weeks culminating in a written and practical examination, in which failure would result in "termination" (BBC Engineering Department, 1966a; Pawley, 1972).

An important aspect of this initial training was induction into what a number of interviewees described as “the grammar of production” and “the BBC way of working”. The TO course lasted 14 weeks, of which the first three were taken by all entrants, before opting to specialise in a particular area (BBC Engineering Department, 1966b). The generic TO training had four major aims:

> 1. To give an understanding of the fundamental principles of broadcasting common to all students and to introduce them to the vocabulary of broadcasting.
> 2. To deal with principles of operational techniques and equipments.
> 3. To develop operational ability by practice in the use of broadcasting equipment
> 4. To instil sound principles for the safe handling of electrical and mechanical equipment (BBC Engineering Department, 1966b).

Numerous interviewees discussed this introductory training and its role in crafting an environment of shared working cultures and a mutual understanding of job roles among technical personnel. One sound recordist who trained at Wood Norton in the early 1970s stated:

> The TO course got you involved with the BBC to start with, it fired you up with enthusiasm for the BBC. We had really good lecturers who would give you lectures in various aspects of broadcasting (Sound Recordist 8).

An OB sound supervisor also discussed this initial training:

> The first few weeks were the same for everyone. They explained everything from what the management structure of the BBC was, to health and safety, to ohms law, how in large scale terms everything is plumbed into the transmitter network and so on. You thought at the time 'oh this is irrelevant to me' but looking back it was really useful. It got everyone on the same playing field (OB Sound Supervisor 8).

A further OB sound supervisor made similar statements, once again pointing to the importance of introductory training and its role in cultivating a shared understanding among production personnel, including those in above-the-line roles:

> You'd go of to Wood Norton and learn the theory, the way the BBC done things. What they were doing was making sure if you snapped someone in two they'd have BBC written right through them like a stick of rock […] Because we were all staff, from the producer, the director to the designer and the costume, we were all in the same building, so it was important to have that understanding (OB Sound Supervisor 9).

Clearly, this introductory training aimed to instil a mutual set of practices and cultivate a shared working culture innew BBC recruits. The identities, cultures, and social norms of television sound operators, and wider production personnel, were undoubtedly further developed in the workplace and throughout their subsequent careers. However, this initial training and the reinforcement of the "BBC way of working" had an influence in shaping the early experiences of sound operators. Furthermore, these few weeks of introductory training were undoubtedly successful in cultivating mutual appreciation of practice among craft personnel, as shall be discussed in Chapter 6.

Beyond this generic training, TOs destined for roles in television sound would receive sound-specific training at Wood Norton before being sent on lengthy attachments with opera-

tional crews. This sound specific training covered numerous technical and craft-based topics, including the following:

1. The principles of electricity
2. Valves and transistors
3. Optics
4. The principles of sound (BBC Engineering Department, 1966).

Upon successful completion of training at Wood Norton, TOs specialising in sound would enter into the workplace in junior positions, such as gramophone or boom ops, often for a number of years, during which time they learnt on the job under the instruction of experienced personnel. Many interviewees likened their training to that of an apprenticeship and often stressed the importance of learning from those in senior roles. However, for almost all interviewees, the most significant aspect of their training experience was the technical and engineering-based training which provided the foundations on which future in-work training and working practices were built. One location sound recordist stated:

> Having left school, I thought I was getting away from all that and going into film and TV only to be taken to a classroom to be sat down doing ohm's law, building resistor bridges and constructing a simple circuit and learning a lot of theory. It was initially wearing white labcoats, I suppose to give a basic physics electronics grounding to get everybody on the same playing field (Sound Recordist 1).

Another location sound recordist added:

> My first memory of the BBC is being in a cold shed in Evesham learning silly things like how to solder a plug and what resistor colour codes were, things like that (Sound Recordist 6).

A third OB sound supervisor stated:

> As far as the training was concerned it was very much about enhancing your education gained at A Level towards broadcasting, you know the physics touched a on bit more than what you learned in school, it encompassed transformers and microphones, frequencies, the broadcast chain (OB Sound Supervisor 6).

For those entering the BBC in the late 1960s and into the 1970s, the technical grounding of their training, as well as the instilment of the BBC's working culture, were defining features of their introduction to television sound. Almost all interviewees spoke extensively about their time at Wood Norton and the vast majority were extremely positive in their reflections on the training experience provided. Generic introductory training injected the culture and ethos of the BBC into the working practices of sound operators and wider production personnel, fostering mutual understanding of practice across production roles. Meanwhile the technical grounding of the sound specific training allowed operators to successfully work with the analogue technologies of their time and complete the routine tasks of maintenance, repair, and adaptation. As shall be shown in Chapter 5, these technical skills were a key component of the skillset of television sound operators and played a significant role in shaping the ways in which sound operators viewed their work.

While technical aptitude and engineering knowledge was a dominant feature in the initial training provided to sound operators in the early stages of their careers, it is important to note that the role of the TO was not a purely technical one. In fact, Edward Pawley (1972) showed that the role of the Technical Operator was introduced in the late 1950s, as increasingly reliable technology meant that the BBC deemed it unnecessary for production technologies to be operated by true engineers:

> Recording ceased to need a separate specialised staff. At the same time there was more work requiring operation skill and experience and less requiring fundamental engineering knowledge. A new category of technical operators was therefore introduced and staff in the engineer and technical assistant categories were thenceforth engaged solely on maintenance work (Pawley, 1972, 530).

Those with purely technical backgrounds would often be entered onto a *Technical Assistants* (TA) course or, if a graduate, would enter directly as an Engineer. TAs and those in Engineer grades were recruited for their "interest in things electrical and mechanical" (BBC Engineering Dept., 1966), and were tasked with designing new equipment and completing the complex maintenance of existing equipment (Pawley, 1972). TOs, however, were expected to have, in addition to maths and physics, some interest in the aesthetic aspects of sound or music. During the selection process for future TOs, "great stress is laid on their interest in the contribution which technical competence can make to the artistic quality of the programme" (BBC Engineering Dept., 1966). Many interviewees also discussed how, in their view, their pursuit of artistic hobbies, such as music or photography, was a major factor in their success in joining the BBC. They felt that, with many school leavers of the period gaining A Levels in maths and physics, it was their interest in these creatively driven hobbies that

set them apart from unsuccessful applicants and those who entered as TAs. As one Film Department sound recordist described:

> All of us had had some sort of interest in amateur film-making, music recording or sound recording. They didn't want engineers really, what they looked for were people that were practical and able to do that sort of thing rather than electronics geniuses or graduates (Sound Recordist 6).

A sound supervisor also argued this point, stating:

> All TOs then had maths and physics, they were looking for a technical base. But, I think it really helped if you told them that you had a tape machine at home and were keen on making and listening to music and that sort of thing (OB Sound Supervisor 4).

Another sound supervisor stated:

> Lots of TOs in my day were employed for their hobby, photographers would become cameramen and people that played around with sound or music would become sound people. But, what you also needed was A Level physics (Senior Sound Supervisor 8).

As well as coinciding with Pawley's findings, the comments of these interviewees also fit with arguments made by Jeremy Potter (1989) in his work on independent television. Potter discusses this decoupling of operational staff from traditionally purely engineering backgrounds as it occurred in ITV franchises. He argues that, as production technologies became somewhat less labour intensive, engineers were made to refocus their attention towards larger

systematic aims such as the development of broadcasting via satellite:

> In the years of maturity their operational role dwindled. The engineers provided the programme production staff with equipment they can virtually operate themselves [...] Today it is in the planning of the systems and networks, the development of entirely new facilities and the maintenance of technical quality that is to be found the true told of the engineer (Potter, 1989, 176).

Clearly then, the role of the TO, as well as non-BBC operational staff, was that of someone both technically competent and creatively aware. Unlike TAs and Engineers, TOs were not purely technical personnel, although a basic knowledge of technical concepts was key to performing their role and using the technologies of their trade, something that was duly reflected in both the recruitment and training process. As has been shown, the training and selection criteria for the TO course was designed in a way to provide a base level of scientific knowledge, onto which the BBC could implement its own broadcast-specific curriculum. However, TOs were not engineers in any strict definition. Tentative notions of creativity and the ability to use technical skill in a creative way featured in a number of accounts provided by interviewees. One sound supervisor stated that the role of the TO was to "technically realise the creative idea" (Sound Supervisor, 2016).

Another OB sound supervisor stated:

> I think then there was a tendency to drop the engineers [from these roles] and it gradually became more and more down to practical and artistic sense. It certainly changed, and I saw it change, in sound operations. It stopped being part of the engineers and communications setup and became part of the operator's domain. It hadn't completely happened when I joined the BBC [in the late 1960s] but certainly by the early 70s things had changed… [but] there was still very much an emphasis on understanding the engineering (Sound Supervisor 3).

Interviewees spoke tentatively about their creative input and often framed this in relation to working creatively around the limitations of their equipment. However, these sentiments illustrate the hybrid role carried out by TO sound operators. TO roles were being filled by those with the capacity, at least to some extent, to demonstrate creative capabilities, despite being selected from applicants with a background in maths and physics who would subsequently be given training in electronics and engineering. In an industry experiencing a period of expansion and rapid technological development while also existing in a state of comfortable duopoly, sound operator roles were no longer being filled by traditional broadcast engineers and were instead occupied by those who bridged the gap between the technical and the creative. In doing so, this personnel freed engineers from operational responsibilities, allowing the focus of engineering staff to be redirected towards the development of large technological systems, such as colour television. However, as shall be argued in Chapter 5, the everyday practices of sound operators in this era were still highly shaped by maintenance, tinkering, and the application of technical skills. As a result, it was these skills that were fundamental in shaping the experiences and professional identities of those working in sound roles in the era of analogue production tools.

From The BBC to University - Training Sound Personnel in the Digital era

> Technical training has always existed but probably reached its peak in the UK during the 1960s and 70s.They [the BBC] had the money to provide suitable training, and the government was supportive too.... and then the accountants noticed the apple on the Tree of Knowledge. Forget training: save the cost. You have plenty of skilled people, and if they leave others can always be bought in from elsewhere. The market will provide, so have a free lunch (Woolf, 2006, 26).

Training is undoubtedly an area that has seen fundamental change as the television industry has reformed itself under the pressures of political opposition, an increasingly competitive market, and the wider drive towards mass participation in HE. As large vertically integrated broadcasters have reengineered themselves to the publisher-broadcaster model and casualised their workforce, the incentives for them to train technical production roles have dropped dramatically. As a result, the availability and form of training offered to potential sound operators has been significantly altered. Coinciding with the changes to the organisation of broadcasters, successive governments have pushed for wider participation in HE and stressed the importance of vocational skills in HE. Resultantly, the majority of those entering the industry in recent years are now being trained on university campuses rather than broadcasters' residential training camps. Undoubtedly, universities and other HE institutions have carved out a significantly different set of priorities, criteria, and approaches to those of the vertically integrated broadcasters who had previously provided industry training. Furthermore, in the era of vertical integration, the BBC existed as a centralised training body tasked, unofficially, with training the majority of the industry in highly established practices, therefore entrenching a shared culture in much of the television production industry. On the other hand, university training is provided by a large number of autonomous institutions with a varied range of methods, staffing, and overall quality. The surge of vocational media courses in universities, which aim to develop skills in what were traditionally thought of as 'craft' roles, has not been coherently or uniformly strategised by those involved in offering such courses, nor univer-

sally welcomed by those in the industry. Resultantly, developments within training provisions have acted to change the way those working in operational sound roles are inducted into the industry and its professional communities. Furthermore, along with this new introduction into the culture of television production, trainees are now provided with a fundamentally different set of skills, knowledge, and practices as a result of this change in training provision. As shall be discussed, particularly in chapters 5 and 6, this has undoubtedly changed the way sound operators work, both with regard to their own distinct practices and the way they operate within the wider production ecosystem.

In recent decades, the traditional divide in television between non-graduate operational staff and production staff who hold degrees has become outdated, as universities offering courses in operational roles, such as cinematography and sound design, have become widespread. Data collated by Universities UK has shown that, in the 2014-2015academic year, student participation is now at 1.8 million students in England alone. Furthermore, this data showed that courses in "communication-based" subjects saw an uptake of 48,000 students, while "arts and design" saw the participation of 166,000 students (Universities UK, 2016a; Universities UK, 2016b). Industry specific data also shows that graduates now make up the vast majority of those working in the creative industries in Britain. In its 2001 workforce survey, Creative Skillset found that 52% of all workers had a degree, of which over half were media related (Creative Skillset, 2001). For broadcast television, this figure had risen to 65% by 2005, while, between 2004 and 2005, the percentage of those entering the audiovisual industries with a degree was 83%, up from 52% for those entering the industry pre-1990 (Creative Skillset, 2005, 98). Again, these figures increase in the 2014 workforce survey, which showed that 72% of those working in television at that point had a degree, with 68% of those working in "sound and audio" educated to degree level (Creative Skillset, 2014).

Following the inception of Surrey University's prestigious Tonmeister course in 1970 (Horning, 2004, 718), the availability of degree-level education for those interested in operational sound production has grown steadily in line with wider media studies courses. Following this trend, in its June 1994 newsletter, the Association of Motion Picture Sound put for-

ward the motion to allow student membership in an effort to "keep in touch with what is happening in the field" (AMPS, 1994, 1). In March 1994, the association held an "extraordinary general meeting" to discuss and vote on the the motion, which passed twenty one votes to one in favour (Allen, 1994, 3).

Furthermore, in an article for *Resolution* magazine in 2010, Dave Ward argued that:

> Today applications are accompanied by a whole raft of qualifications...From just two or three reputable courses in the 1980s, the number of academic opportunities has mushroomed (Ward, 2010, 49).

In keeping with Ward's assertion, data from *Unistats* (2016), a website funded by the Higher Education Funding Council for England, has shown that, in 2016, there are 45 courses available at British universities which are related to "audio engineering" and a further 51 relating to "sound production" (less specifically, "television", has over 300 dedicated courses). Furthermore, JAMES (Joint Audio Media Education Services), an industry body set up by professionals with the aim of fostering better relations between academia and industry, has accredited "audio" courses at 25 separate universities (JAMES, 2016).

The rise of media and production degrees has coincided with the reduction in the BBC and ITV franchises' role in training (Bell, 2004). With increased commercial pressures affecting the broadcaster practice, the reduction of training provision presented an opportunity to reduce costs with little immediate impact on production. Furthermore, the increasing use of freelance staff following the shift away from permanent employees strengthened the incentives to reduce training, as Stoyanova commented:

> Different stages of deregulation and commercialisation of the industry removed that role from them [the BBC]. With the shift from internal to external labour market, the incentives to train lessened and so did the resources which they could dedicate to in-house development[…]the BBC started bringing people in as opposed to using resources to train them up and, little by little, the in-house training provision was considerably reduced (Stoyanova, 2009, 190).

Stoyanova's broad assertion remains accurate when applied directly to sound-specific training. In a 2006 article for *Line Up*, Malcolm Nelson illustrated the reduced role of the BBC with regard to training:

> BBC Wood Norton's TV Training Manager, Alan Tutton, assured us that, contrary to popular belief, the BBC was still very active in training. However, the organisation could no longer afford lengthy schemes of formal training, shadowing and work experience,especially now that many staff are employed on short term contracts. Short, intensive training courses,some available to freelances at a discount, are designed to develop or improve specific skills (Nelson, 2006, 18).

These concerns did not wane in the years between 2006 and 2013. In an open letter to George Entwistle, then Director General of the BBC, Simon Bishop, Chair of the Institute of Professional Sound (IPS), voiced the organisation's continued concerns about the reduction of BBC resources devoted to the training of sound operators:

> No TV sound operational hands-on training coordinated by the BBC Academy, or anyone else as far as we can discover...BBC Academy sound trainers, will all, bar one, be made redundant in April of 2013 (IPS, 2013a).

This shift in the availabilities of training, from in-house training to academic training at universities, has also been noted both in interviews conducted for this research and in the wider trade press. As stated before, the influence of BBC training is felt widely among those interviewed for this research. Almost all interviewees now working in senior positions were trained at vertically integrated broadcasters, and the vast majority at the BBC. Among these interviewees, there is a common theme of concern regarding the training provided by universities, which is characteristic of much of the wider debate on university-level vocational education. One former dubbing mixer questioned the validity of university training:

> How do people learn the craft skills to know what to do with all this wonderful kit? Because analogue was labour intensive and therefore there was endless opportunities to learn. That is no longer so obvious because assistants have vanished off the face of the earth both in picture and sound cutting rooms. So how do people learn? And I'm not convinced that even the good film schools, let alone the crummy ones, and the universities are actually helping that much. So, there's the big question, where do the next generations come from with the critical facilities to know what do to do with the beautiful toys? (Dubbing Mixer 3).

Another dubbing mixer, now lecturing at further education level, expanded on the theme:

> With a university only part of it is actually about training, the rest is about learning and being academic. Really, you've got to learn within the environment on the job, you can't just concentrate on the creative blue sky thinking side of it, you need good technical underpinning, you need to know why you're doing things […] At the BBC, we spent three years as a trainee, now you'd be lucky to spend three weeks as a trainee in industry (Dubbing mixer 6).

One OB senior sound supervisor interviewed stated:

> Sadly, with notable exceptions, the universities aren't really doing it for sound. I meet lots of people who have come straight out of university, who have done media production type courses, who have a BSc, and they didn't understand the basics, what I'd consider to be the basic science in my field, because they'd never been taught it (Sound Supervisor 7).

In the words of another dubbing mixer:

> It seems now that the people coming out of universities and media colleges know computers and know Pro tools very well. They are really fast and efficient at mixing in the box which I'm just not really but it does seem that they lack some knowledge of why we do things the way we do. We used to do them that way because it was the only feasible way to do it (Dubbing mixer 1).

Clearly, for the interviewees trained in this era, the implications of the shift in training is a cause for genuine concern, as these changes impact directly on the skills that have been established by seasoned professionals over many decades. The concerns stem from the lack of

technical focus and the increased importance placed upon academic considerations which, as briefly discussed below, has been at the centre of extensive debate in the wider field of media studies. Furthermore, there is clear concern around the issue of the 'grammar of production', as evidenced by the interviewees' desire for new industry entrants to know "why we do things the way we do". While there are few practical benefits to knowing the historical reasoning behind production practices, this was repeatedly cited by interviewees as a cause for concern when discussing current training provisions. While not an association directly expressed by the interviewees, the notion of "knowing why" was clearly tied to the shared ethos and culture that was so entrenched in the BBC training and so glaringly absent from university-based training. For those trained by the BBC, the wider context within which their practices were conducted and understanding its implications were fundamental to TO training. There was a clear concern among sound operators that this is no longer the case.

The changes to training differentiate the new entrants to the industry from those currently holding senior positions and have affected the professional identity of those working in television sound. The concern and scepticism apparent in the accounts of interviewees was not limited simply to interviewees' personal views, with trade publications littered with examples of writers who question not only the content and quality of this training in comparison to that previously provided by the BBC, but also the motivations for providing it in the first place. In an article for *Line Up*, Hugh Robjohns questioned the influence of HE targets, suggesting that meeting these targets, rather than providing high quality training, is the primary motivator for many universities:

> Moreover, the former 'traditional' training routes for newcomers have almost become extinct. Instead, in the UK we now have a glut of universities keen to provide 'attractive' semi-vocational courses –- like media and music technology -– essentially to achieve government targets for students in further education. This target-lead approach inevitably brings concerns over the quality and relevance of the training provided (Robjohns, 2011).

In an article for *Resolution* focusing on education in the industry, Melyvin Toms and James Ward stated that

> Exponential growth in quantity has not, unfortunately, always been matched with the quality of education that the industry would desire or expect (Toms & Ward, 2011a, 49).

In a following edition of *Resolution*, both writers again voiced their concerns about the growth in university training courses:

> There is nothing wrong with this in principle, as long as the educational aims are genuine...However, there have been some establishments that have used dubious marketing to swell student numbers and gain from subsequent funding advantages (Toms & Ward, 2011b, 61).

In another article for *Line Up*, Malcolm Nelson urged members of the IPS "not to write off people who attend media courses" (Nelson, 2006, 18).

The concerns of those interviewed and those writing in the wider trade press are, of course, not entirely unique to the profession of sound operator, or even television production as a whole. These trends can be seen in multiple industries and must be assessed within the wider context of educational reform and the push toward vocational education experienced in Britain throughout the latter decades of the Twentieth Century.

Taking place in parallel with the transformation of broadcasting organisations, universities and HE institutions in Britain were experiencing changes as fundamental to their own operations as the changes experienced by big broadcasters. During this period, HE, much

like broadcasting, saw changes that were characteristic of wider shifts in the British and worldwide economic and political outlook. Manuel Castells (2001) argued that, in many nations, society was, during the latter decades of the Twentieth Century, fundamentally restructured from the "industrial society" into the "network society". Using digital communications technologies, national economies, as well as other aspects of organised society, have been able to decentralise and reorganise themselves from economies reliant on large scale rigid organisations to those characterised by networks of flexible autonomous components. These autonomous components allow for much greater flexibility for the institutions overseeing and regulating an economy while enabling it to operate on a significant scale, doubling, as reported by Castells economic growth rates in the US and Europe going into the new millennium (Castells, 2001, 8)[5].

As a result of this shift, the nature of the workforce and, significantly, its relationship to training have been forced to adapt in an effort to maintain desirability within this societal structure, a process Castell has referred to as "self-programmable labour" (Castell, 2001, 10), arguing:

[5] The events of the 2008 global financial crisis and the ensuing economic recessions experienced across much of the Western world undoubtedly temper Castells' assertions about the impact of the network society on economic performance. Despite the hugely damaging impact of this crisis, the structure of the UK economy remains largely in line with Castells' network society model. As of 2013, services, driven primarily by banking, insurance, and real estate made up almost 80% of the UK's GDP, up from 46% in 1948. Meanwhile, manufacturing amounted to only 15% of total GDP, down from 42% in 1948. The UK is now more reliant on services than any other major world economy, although the US is a close second. Furthermore, data from 2012 shows that 85% of the UK workforce is now employed in the services industry with only 10% employed in manufacturing and just 1% employed in agriculture (Office for National Statistics, 2017a)

> Networks are those that hire and fire workers on a global scale. It follows structural instability in the labor markets everywhere, and a requirement for flexibility of employment, mobility of labor, and constant re-skilling of the workforce. The notion of a stable, predictable, professional career is eroded, as relationships between capital and labor are individualised and contractual labor conditions escape collective bargaining (Castell, 2001, 9).

In recent years, Michael Tomlins (2013) built on Castells' network theory and directly addressed the relationships between education, work, and the economy within this new organisational model. Tomlinson highlighted the prominence of "human capital" and "meritocratic" schools of thought in the shaping of government education policy, particularly in economies where the network society, or 'knowledge economy' is highly developed, such in as the UK and US. Tomlinson has posited these factors as a driving force behind the expansion of post-compulsory education in the pursuit of economic growth and the more equal distribution of opportunity, particularly through vocational training and education. Tomlinson pointed to the introduction of a number of vocational qualifications, such as NVQs and GNVQs, ushered in by Margaret Thatcher's Conservative government, as a direct example of policy attempts to align learning more directly to future employment needs.

The move towards the dominance of the network society, or knowledge economy, has also had significant effects on the role of HE and built upon policies of expansion and access introduced in previous decades. The 1963 Robbins Report spearheaded the expansion of the HE system as a pillar of the wider welfare state. At the time of the report, university participation in the UK was just 6% (Committee on Higher Education, 1963; Anderson, 2006; Tomlinson, 2013). As a key recommendation, the report set a target for participation to increase to 17% by 1980. However, the report did not call for the full scale remodelling of the university

system itself or for a particularly strict adaptation of its longstanding ethos of advocating the pursuit of knowledge over applicable skills. The report simultaneously advocated for "skills suitable to play a part in the general division of labour", while criticising specialisation in undergraduate study and urging universities to focus on broad learning objectives that "promote the general powers of the mind" (Committee on Higher Education, 1963).

While the Robbins Report made the recommendation to open up university status to technical colleges in an effort to achieve parity among these institutions, this recommendation was rejected. Instead, in 1965, the so-called Binary System (Briggs, 2009) saw the creation of thirty polytechnics which would operate alongside universities with a focus on high level vocational training and skills (Anderson, 2006; Tomlinson, 2001). By 1980, HE participation had increased, achieving a rate of 13% by 1980. Of this figure, polytechnics were represented disproportionately (Whyte, 2015; Anderson, 2006) and, following the Further and Higher Education Act of 1992, existing polytechnics were given the right to rebrand themselves as fully fledged universities (Whyte, 2015; Shattock, 1996). Almost overnight, this resulted in the introduction of a raft of vocationally focused institutions (institutions with university status rose from 47 to 88) into the existing university system. The influential Dearing Report of 1997 further strengthened the transition to universities offering courses that reflect the need for skills in the economy. The report advocated ensuring that HE was "increasingly responsive to employment needs and include the development of general skills, widely valued in employment" (National Committee of Inquiry into Higher Education, 1997, 3).

The increased presence of vocational training at universities was also accompanied by wider political influence that had a marked effect on the way universities operate (Whyte, 2015). This period saw the marketisation and professionalisation of universities, as the government attempted to introduce competition into the HE system (Naidoo, 2005). Facing harsh spending cuts (funding per student fell 40% between 1977 and 1997) (Shattock, 1996, 15), universities were encouraged to look to increasing operational efficiency and implementing more businesslike management structures as a means to weather the funding deficit. This focus on efficiency, performance indicators, and financial consciousness was compounded

when, in 1985, the Research Assessment Exercise was introduced in an effort to monitor research output and quantify productivity. While good RAE performance had considerable financial benefits, for post-1992 universities, who lacked an established research remit and practice, this system was inherently disadvantageous and forced such institutions to look for other means of attracting students, and subsequently funding, to their courses.

Although these developments had a clear impact on HE provision in Britain, arguably the most significant factor in the shifting dynamic of university education is that of tuition fees. Introduced initially by the then Labour Government in 1998 and subsequently revised in 2004 and 2010, tuition fees changed the relationship between student and institution. This new financial relationship fostered the concept of students as consumers of university courses (Naidoo, 2005, 29) in a sector that was becoming increasingly business-oriented in the context of competition and reduced state funding. While elite universities could, and continue to, rely on tradition and reputation to project their market value, other universities now have to keep pace in an increasingly competitive market in which students are increasingly aware of the value of their investment. Anderson (2006) argued that, in this market, for many universities, "the problem is recruiting students rather than selecting them" (Anderson, 2006, 195). Anderson's claim is particularly pertinent to fields such as media and film studies. Accusations aimed at media departments for offering superficially attractive courses that promise too much to unsuspecting undergraduates in a bid to secure precious funds have been commonplace in the press and, as evidenced by those interviewed for this research, and those already working in the industry (Elliot, 2000; Rowe, 2004; Bell, 2004; MacDonald, 2006).

Beyond defending itself from accusations of illegitimacy, media studies, and its constituent fields, has faced various other struggles and criticism since its rapid rise as a result of the Robbins era expansion. Foremost of these struggles is the fundamental question of theory versus practice in university media courses (Elliot, 2000; MacDonald 2006; Bell 2004). Desmond Bell (2004) argued that, as this field of study developed, scholars eagerly set about adapting their academic practices to establish new methodological approaches and critical frameworks within this new discipline. In doing so, they sought to find ways of working suc-

cessfully to the confines, and rewards, of the 'publish or perish' criteria of the RAE, a yardstick that is often inhospitable to the alternate forms of publication and output produced in media departments (Parker, 2005). However, these theoretical approaches were often at odds with the extensive vocational pledges made by institutions and the increased demands from students for ever more industry-standard technology and hands-on instruction, as they pursued a degree that they believed would fast-track them into a job (Rowe, 2004; Bell, 2004; Elliot 2000). For proponents of university education in its traditional form, practice-based approaches reduce education to the formulaic development of established skills without the critical and contextual capabilities that would enable graduates to gain meaningful employment. In the traditional approach, a university's separation from the workplace is an asset, not a deficiency, as it allows for critical and creative exploration of the subject matter. However, the increasing advocacy of university education being used as a springboard for access to the marketplace posits theory as a self-indulgence that interferes with students' ability to obtain marketable skills. This notion marginalises theory-based approaches in favour of increased hands-on learning and ever-closer ties to industry in an effort to serve market demand (Ellis, 2000; MacDonald, 2006). Clearly, the challenge of delivering an effective and efficient form of training would-be industry professionals has been fraught with difficulties for those attempting to organise and disseminate it.

In addition to the internal struggles described above, universities offering media studies courses have had to adapt to, and defend themselves from, considerable input from the industry body Creative Skillset, and by extension, the UK Film Council and Ofcom. In 2004, Creative Skillset launched its Bigger Future training strategy which, it argued, would "impact on the long-term success and sustainability of our film industry and its prosperity on the world stage" (Creative Skillset, 2004, 6). In its strategy document, Creative Skillset was critical of existing training provisions, most notably university courses, and called for a more vocational approach, highlighting what it called "the problem" with existing training:

> Over the last 20 years there has been a massive expansion in courses which provide opportunities to study the media, film and communications. Yet there is a clear perception right across the film industry that only a few of these courses deliver the right mix of vocational skills which equip students to enter the industry...There is a clear distinction to be made between academic study and vocational provision. Students could and should have a better understanding of what skills the industry demands and needs (Creative Skillset, 2004, 17).

Creative Skillset set out a number of provisions to tackle this 'problem', including the establishment of a number of accredited "Screen Academies" at those universities that it felt met the required standard of vocational provision, and the provision of funding and access to a host of industry resources for these academies. In addition to these academies, Creative Skillset established a network of approved courses at other universities, which would be able to obtain extra funding through the national lottery and the industry itself (Creative Skillset, 2004). Clearly, Creative Skillset aimed to be a leading player in the provision of media education at further education (FE) and HE level, and had little faith in the universities' ability to provide this unsupervised. However, the ambitious aspirations of Creative Skillset to be a leader in training and education chafed with the established media studies providers at the universities. Ian MacDonald (2006) showed how many in HE saw the *Bigger Future* strategy as overzealous in its attempt to put employers at the heart of education and unjustified in its efforts to micromanage curricula through the award and withdrawal of funding, arguing that the strategy represented:

> A much stronger approach than we all envisaged in the 1990s, when we seemed to be converging in our intentions [...] we cannot allow ourselves to be sucked into a particular philosophy, just because it is politically convenient. It is important that we encourage students to take a broader stance, as well. It is important that we relate to both critical and vocational discourses...this is the opposite of the Skillset approach (Macdonald, 2006, 140-141).

More recently, Duncan Petrie also criticised the *Bigger Future* initiative, stating:

> The educational activities of these two key institutions [the NFTS and LFS] remain much more complex and indeed interesting than the reductive and instrumental vision of skills-training advocated by Skillset in A Bigger Future (Petrie, 2011, 137).

This problem of theory and practice is not seemingly limited to the UK. In her work on the National Film School of Denmark (NFSD), Eva Redvall (2015) provided considerable insight into the television-specific teaching offered by the school in close collaboration with the Danish state broadcaster (DR). Redvall illustrates that television was not taught, in any way, at NFSD until 1996 and that, when it was introduced, a strict course framework placed creativity, not craft skill, at the heart of teaching. She went on to state that:

> The strict framework emphasises creativity within industry constraints...the creative process of each student is important but the TV term is first and foremost a course on collaborating (Redvall, 2015, 82).

What is undoubtedly clear in Redvall's work is that, like in the UK, the priorities, objectives, and overall ethos of NFSD makes it difficult to marry the values of the artistic and creative aspects of film and television making with technical or craft-based considerations. While courses in craft- based roles, such as cinematography and sound, may well have a more

technical focus than more generic media or film studies courses, they are still delivered in a manner that adheres to the wider culture and ethos of the institution in which they are taught. Arriving at an established coherent set of objectives has clearly been a considerable struggle for universities and higher education institutions as they take on the task of providing training to the creative industries, as issue that has clearly not been fully achieved. The frictions between theory and practice and the debate around what should take precedence in the training of future industry personnel have persisted, even in recent years.

As evidenced above, the concerns and criticisms put forward by interviewees and the trade press alike are not unfounded and are, in fact, symptomatic of systemic challenges that are still being overcome in higher education today. Attention to the technical considerations of sound operation in the training of new personnel has diminished, as the industry shifts from entirely bespoke and resolutely established broadcaster training to hybrid training delivered by institutions still in a state of relative uncertainty about the form of training they seek to provide. Furthermore, in the current fragmented training environment, it is hard to imagine that any coherent set of practices and working cultures could be established and implemented with any real uniformity. As a result, the shared 'grammar of production' repeatedly cited by interviewees trained in vertically integrated broadcasters is no longer a universally inbuilt component in operator training.

Concerns regarding the inherent shortcomings of the training provided by universities are apparent in the accounts of those who experienced this first hand. Those interviewed for this research who had attended university often commented that their training was not only broad in its content but also lacking in both technical and industry-specific focus. This is clearly in stark contrast to the tightly focused training provided by broadcasters, which provided their personnel with skills and knowledge honed over decades by those in the roles trainees would later be occupying. As one interviewee who studied music technology before going on to work as a runner and then a dubbing mixer stated:

> When I left uni, I quickly realised I wasn't really equipped to do this job at all, even though I was pretty good at using Pro Tools [...] not only from a technical point of view but also from the social point of view, they just didn't teach that stuff (Dubbing Mixer 4).

A freelance location sound recordist who graduated from an undergraduate course in film and television production stated:

> I didn't do media or anything at A Level, but I decided to do it, as I thought the theory sounded interesting and that I'd be quite good at it [...] The course seemed really influenced by what the lecturers were interested in, and my lecturer wasn't really interested in location sound. It wasn't until third year that I even got my hands on a recorder. My lecturer was really into sound design and that sort of thing so there was a lot of focus on that. Towards the end I actually stopped attending a lot of things as I thought I could get more experience and training working voluntarily as an assistant (Sound Recordist 9).

Another interviewee who studied sound production for film and television and now working as a location sound recordist stated the following:

> We weren't really taught any real technical stuff, we were taught how to operate equipment, obviously, but not how to mend it or anything like that [...] as well as the actual operational stuff, there was quite a lot of focus on and essays about things like sound theory and how sound affected narrative (Sound Recordist 10*)*.

The accounts of these relatively new industry entrants demonstrates the friction that exists between theory and practice in the training provided by universities, as well as the broad and variable approach to training taken by these institutions. Clearly, training for those working in television sound has changed fundamentally. Those in the industry who were trained during the era of in-house training have a severe distrust of the quality and availability of the training for those entering the industry in recent years. This distrust stems from the absence of a technical grounding that is found in most university media and production courses. Furthermore, the lack of on-the-job training available in the now-freelance television industry and the inability of many universities to provide any extensive work based training strengthen the concerns voiced by those in the industry. These concerns are vindicated, at least to some extent, by the accounts of those who received their training at universities, who voice their own concerns about several aspects of this training. As large vertically integrated broadcasters have distanced themselves from the training of new industry entrants, this responsibility has fallen to institutions that are themselves in a continuous state of transition.

Higher education in Britain changed fundamentally in the second half of the Twentieth Century, in which vocational education was incorporated wholesale into the remit of university operations, as successive governments championed vocational education and the skills it provides, as paramount to the prosperity of the wider economy. Simultaneously, universities were subjected to decreased funding and the increased influence of market forces, the effects of which made all the more severe by the introduction of tuition fees and the consequent im-

position of consumer status on students. The traditional remit of universities as exclusive cultivators of thought, which, in the broadest sense, promote the power of the mind, has been infiltrated by a philosophy that now fosters employability and seeks to build skills applicable to the wider economy. Media studies, a relatively new subject that now has a significant presence in academia and university life, embodies this shift in the educational remit of universities. So too, however, does it embody the struggles involved in this transformation and the friction between the traditional university remit and the vision of HE as a tributary to the 'real world' economy. These shifts and continued struggles in educational provision are directly reflected in the type of people working in television sound and the way in which they approach and think about their work. Edward Pawley (1972) discussed how the role of the TO, the position traditionally held by sound operators at the BBC, was launched as a result of equipment and practices becoming less labour intensive and "less requiring of fundamental engineering knowledge" (Pawley, 1972, 530). Accounts provided by those working as TOs show that this role clearly incorporated numerous skills that could be considered fundamentally engineering-based, as evidenced by the accounts cited in this chapter, as well as those cited in chapters 5 and 6. However, for operational personnel, the role of the TO represented a departure from what the BBC had traditionally perceived as broadcast engineering. Clearly, this distancing of sound operators from 'true' engineering has become further engrained as training has migrated from vertically integrated broadcasters to universities and other HE institutions. Accordingly, the way in which sound personnel approach, conduct, and think about their work is now fundamentally different to previous decades.

Innovation

This chapter provides an analysis of the role of television sound personnel in the development of sound production technologies. It shall be argued that, as a result of industrial and technological shifts, operational sound personnel now feel that they have less influence on the development of technologies by manufacturers and hold a less powerful position in the innovation process. As the industry has moved away from vertically integrated broadcasters, the voice of end users in the processes of innovation has become decentralised and harder to coordinate, as evidenced by both those in operational roles and manufacturers.

Large scale broadcasters, in particular, but not exclusively, the BBC, played a pivotal role in establishing the technological framework for the development and implementation of new technologies in television sound. As employers of large numbers of end users and highly trained engineers, broadcasters were in a position to work closely with manufacturers in a number of ways. Dedicated research departments at these broadcasters provided manufacturers with detailed testing, meaningful feedback, and, in many cases, significant assistance in the development of new equipment. Furthermore, providing access to a large number of highly trained and technically literate end users, they were able to actively incorporate these users into the process of technological development. This provided end users with the agency to impact on developments and had a significant influence on the way operators perceived their work and role in relation to manufacturers and innovation. However, the relationships end users share with manufacturers has seen widespread change as British television production has shifted from large vertically integrated organisations to being an industry increasingly reliant on outsourcing, downsizing, and freelance labour. Freelancers lack the infrastructure, expertise and financial resources to make meaningful demands of manufacturers or to instigate wider industry-standard practices. As a result, operational sound personnel now feel increasingly disconnected from manufacturers and view their power in the innovation process as diminished.

Existing literature on innovation in sound technology has tended to focus on the invention of sound recording and its subsequent integration into film. While a number of studies have focused on the industrial practices surrounding sound technology innovations (Douglas 1989; Sterne, 2003. Wurtzler, 2007), these have focused almost exclusively on the American film industry and do not often look at innovation beyond the introduction and normalisation of 'the talkies'. As recently as 2015 Kevin Donnelly wrote:

> Research dealing with film sound has tended to concentrate on the transition to recorded synchronized sound and the early years of the new amalgamated medium, rarely venturing too far beyond the 1930s. Other periods of radical change for sound in the cinema have been less well served (Donnelly, 2015, 55).

Furthermore, current literature on production studies, understandably, focuses almost exclusively on the use and operation of technologies by technicians, but rarely deals with technicians' own contribution to the development of their professional tools. Clearly, technologies that have already attained, or are soon to attain, industry acceptance dominate the daily professional lives of those working on production and, as a result, production studies researchers have little need to evaluate the processes of innovation. However, how these professionals access new technologies, contribute to their development and, ultimately, accept or reject them has a distinct effect on both professional practices and wider job configuration. Therefore, the processes of innovation surrounding production technologies and the involvement of end users deserve further scrutiny.

This chapter aims to address this need for further examination by looking specifically at the industrial cultures of innovation surrounding television sound technologies in Britain and how these practices have changed as a result of the industrial restructuring experienced throughout the 1980s and 1990s. In doing so, it assesses how the perceived role of end users in the development of new technologies has changed and how their ability to do so has been affected by wider changes in the labour environment. Clearly, industrial and technological

shifts affect a wide variety of production and broadcast technology, not just sound technologies. However, it is beyond the scope, and outside the remit, of this research to incorporate an analysis of production technologies beyond sound-specific roles. The accounts of a number of industry-standard equipment manufacturers feature more prominently in this chapter, in addition to the interview data obtained from the sound operators, which makes up the bulk of this research. These include Mark Crabtree of AMS-Neve, Douglas Macintosh and Joseph Parys of SQN Mixers, John Gozzard and Simon Davies of Rycote Windshields, Jim McAllister of Black Box Video, and independent equipment engineer Chris Woolf. Where manufacturers provided multiple interviewees, these interviews were conducted separately, as these interviewees often represented distinct and varied periods in the company's development. Additional interview data includes that obtained from Nigel Woodford of industry-leading hire company Richmond Film Services, which, although not producing equipment itself, is at the forefront of development.

Technological Frameworks in the Era of Vertically Integrated Broadcasters.

As detailed in Chapter 1, the importance of the technological framework to innovation has been argued by numerous historians of technology. As evidenced by the work of Bijker (1989), Hughes (1994), Williams and Edge (1996), and Sterne (2003), innovation is not a linear process driven by individuals, and, instead, occurs within a wider context of knowledge, resources, and practices known as the technological framework. Such frameworks help establish a shared meaning for the processes of innovation, and allow these processes to be steered in a direction that most effectively serves the dominant social group operating within them. The role of the technological framework can be seen in the work of these scholars in relation to the development of a wide range of innovations, from railway systems to bicycles and plastics.

Although not labelled as such, technological frameworks are, again, a significant feature of accounts of technological development in the fields of film and television studies. Allen and Gomery (1985) were highly critical of 'great man' theories of invention in historical studies of film technologies. They argue that, instead, invention in motion picture technology is built on a "system of concepts linked together" (Allen and Gomery, 1985, 114). While not labelled as such, what Allen and Gomery are describing is clearly a technological framework. The same year, Bordwell, Staiger, and Thompson (1985) similarly argued that American studio cinema only became a possibility when systematised and guided by large scale institutions. In more recent years, Limin Liang (2013) has shown that the cloud-based production system used in the coverage of the 2008 Olympics was only possible due to the technological framework established by closed circuit television (CCTV). This framework brought together broadcast engineers and programme makers, who were able to use CCTV to develop an early network-based production system. What is clear from the above-mentioned findings, both film-specific and from wider industries, is that establishing a technological framework is fundamental to development and innovation, particularly with regard to large-scale technological systems.

By the 1960s, television had already become a significant industry inhabited by large communities of professional personnel with an established technological framework, as evidenced by the work of Aldridge (2012) and Briggs (1965; 1979; 1995). The feasibility of television had, in principle, been established by early developers such as J.L. Baird and EMI. However, it was within the framework of the BBC, with its large engineering resources and experience of radio broadcasting, that television became a genuine broadcast medium. In the years following World War Two, television continued to flourish and establish an entrenched industrial and technological framework. Having enjoyed a significant increase in licence fee revenue (Briggs, 1965; 1979; 1995), in 1955, the BBC purchased Ealing film studios (Chapman, 1960), significantly bolstering its film production activities. That same year also saw the launch of ITV as a commercial competitor to the BBC. While technically competitors, these two organizations, funded by entirely distinct revenue streams, soon found themselves in a

state of ‘comfortable duopoly’ (Ursell 2000b; Born 2004). This dynamic continued uninterrupted until fundamental change was ushered in in the 1980s and 90s, in which television was an industry characterised by very well resourced vertically integrated institutions with an entrenched set of practices, accepted knowledge, and extensive workforce. Clearly, during this era, the technological framework of British television, the key to successful innovation, was both dominated and shaped by these institutions.

Interviewees and textual research consistently point to broadcasters as playing an instrumental role in the technological framework of television and, subsequently, the innovation of sound equipment in television during this era of vertical integration. The role of broadcasters can be described as twofold. Firstly, broadcasters, through their large and highly respected engineering departments, worked directly with manufacturers on the design, development, and testing of new technologies. As large unit buyers and mass employers of end users, broadcasters were able to spur cooperation among relevant groups to both instigate and influence design and practice, as well as assimilating knowledge and reducing risk. Through their engineering departments, broadcasters were able to give high quality practical assistance to manufacturers, thereby accelerating the innovation processes of small manufacturers. Their second role involved the establishment of industry standards, both official and unofficial. Being such large players in the industry, the BBC and ITV franchises had the ability to propel technologies and practices to industry-standard status, as smaller unit buyers kept in step with practice at the BBC and the ITV franchises. Furthermore, as employers and trainers of a large numbers of end users, broadcasters, in particular the BBC, shaped these users’ practices, and, in so doing, coordinated the interpretive flexibility of these technologies. As previously discussed, the BBC was acknowledged as being the industry’s key training body and it was common for ITV franchises to rely on increased wages to tempt away BBC-trained staff (Houseley, Nicholls, and Southwell, 2001, 182; Ursell, 2000b, 748; Langham, 1996, 79; Seaton, 2015). This symbiotic relationship between the BBC and ITV franchises in relation to training and recruitment helped to reinforce the foundation of the industry’s technological framework and distribute a widely undeviating set of practices and common knowledge. Unlike the example used by Pinch and Bijker, in which the social groups studied are wildly dif-

ferent (young men interested in sport and women interested in safety), even sound operators working outside the BBC were likely to have received, or have been influenced by, a generally uniform training and, therefore, operated in an established industry with an entrenched set of practices laid out by a dominant central organisation.

Cases of broadcasters working closely with manufacturers and fostering absorptive capacity can be seen throughout the research interviews presented in this paper and written sources. Primary examples of this are found in the testing activities conducted by the BBC on behalf of both British and international manufacturers. A number of Research Department technological reports, regarding the testing of future industry standard microphones from Sennheiser and AKG, give details of both the testing procedure and subsequent communication with manufacturers. The reports show that the BBC tested numerous performance aspects, including frequency characteristics, impedance, sensitivity, noise and interference. The results of these tests are highly detailed and include numerous circuit diagrams, illustrations, and lists of components. What is also evident from these reports is the communication and collaboration between the BBC and manufacturer. In the case of the AKG 628 microphone, the report touches on some unsatisfactory results:

> It will be seen that although the axial response is maintained up to 15 kHz the response for sound incident at 90 degrees falls off rapidly above 5 kHz. Furthermore, the 180 degree curve is only about 5 dB below the axial curve at 6 kHz. The makers state, however, that this will be corrected in the production models (Harwood, 1966, 3).

Technical jargon aside, what is demonstrated by this quote is the role of the BBC in the early stages of testing and the importance of this testing to manufacturers. As the microphone in question was a prototype, this testing was not simply for the benefit of the BBC itself, but clearly had some value to AKG, which, by providing a sample of the microphone before it

entered production, exposed the new device to expert inspection while allowing itself time to react to feedback. If this testing was simply for internal BBC use, the BBC could simply have acquired a production version of the microphone once it had entered the market. Communication between the BBC and AKG is also clearly evidenced by this quotation, in that it shows that AKG agreed to correct the issue made apparent by the testing. While it cannot be ascertained whether this correction was already planned by AKG, what is clear is the connection and responsiveness existing between the BBC and AKG throughout this early testing period.

Fig. 12: SQN 1 Mixer (Photo: Tim Heath)

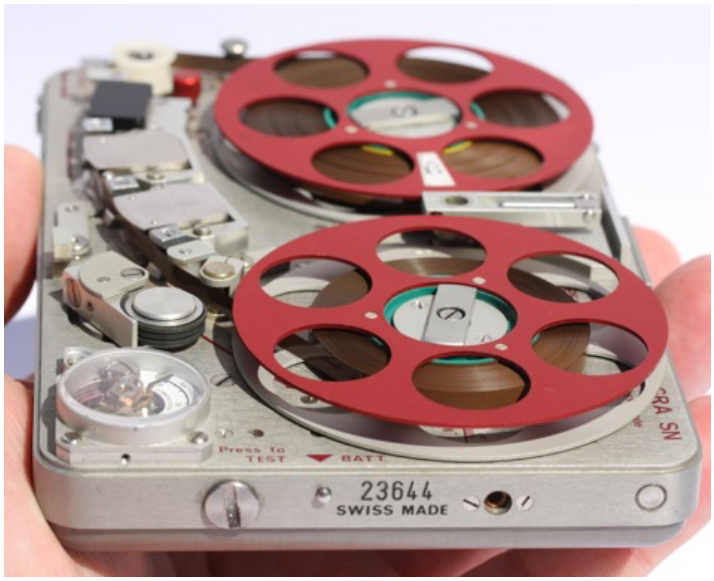

Fig. 13: Nagra SN Mixer (Photo: musicofsound, 2017)

A further example of early-stage testing and subsequent manufacturer responsiveness was made clear by Douglas Macintosh, founder of SQN. Macintosh discussed the role of the BBC in testing and making recommendations for the adaptation of a prototype version of their SQN 3M mixers. In the run-up to the 1982 World Cup in Spain, the BBC required a small front-end mixer for portable video shoots, as all coverage of the competition was to be undertaken using videotape. Before the development of the 3M in 1978, SQN mixers had been designed specifically for application as a front-end mixer for the miniature Nagra SN recorder. Originally designed in 1970 as a surveillance tool for intelligence agencies, the Nagra SN gained popularity with documentary sound recordists for its light weight and portability. However, the low quality inbuilt microphone and automatic level control made it unusable for television purposes. The SQN 1 (see Fig. 12) was developed in 1975 specifically with the Nagra SN (see Fig. 13) in mind and allowed for both the use of external microphones and accurate level control.

Known as *the 3* because it was a 3 channel mixer (See Fig. 14), the SQN 3C soon followed, . It was a larger mixer that allowed for more channels, as well as physically housing and directly docking the Nagra SN to the mixer via specially designed connectors.

Fig. 14: SQN 3C, the first 3 channel mixer produced by SQN (Photo: SQN, 2017)

With the steadily increasing use of videotape in production and the demand for a mixer compatible with standard-sized Nagra recorders, SQN set about designing a universal 3 channel mixer without the SN housing. Douglas Macintosh discussed the role of the BBC in testing this new mixer:

> Someone from the BBC OB department said "what we need really is like the front end of a tape recorder, this looks like it so could we have one to look at please". So we sent them one to look at and after a while they wanted 13 changes made to it. None of them posed major problems to us so we said 'ok you can have that' and once we changed it to the way they wanted it they ordered about 40 of them. These changes were then implemented for all further sales, everyone got the BBC version (Macintosh, SQN, 2015).

These changes requested by the BBC ranged from significant design features, ranging from the addition of direct monitoring of mixer input and output to the simple swapping of connectors. Significantly, however, these were not bespoke modifications made specifically for the BBC and were, instead, fully incorporated into the design of the production version of the mixer, remaining so for its entire 10-year manufacturing lifespan. Much like the earlier example of the AKG microphone, this again illustrates the role of the BBC in early-stage testing and the direct pathways of communication between the BBC and manufacturers during the innovation process. In the case of SQN, the BBC's significant engineering expertise enabled it to both highlight features that would improve the design and give meaningful suggestions for change. Furthermore, the role of the BBC as a significant customer acted, at least to some extent, as a way to reduce the risk involved in innovation and, therefore, give momentum to otherwise risky ventures. Macintosh went on to give a further example of this occurring beyond the BBC, when discussing the development, in 1984, of the SQN 4 stereo

mixer, which would go into production in 1985. By requesting a stereo mixer, Thames Television instigated the design and development of the stereo SQN 4, while also minimising risk for SQN by simultaneously ordering units for its significant number of employees. The SQN 4 would go on to achieve industry-wide acceptance and help SQN achieve an annual revenue of £1 million. As Macintosh stated:

> We hadn't been making the mono mixer long before Keith Barber at Thames asked us to make a stereo one. Well, there was no stereo broadcasting at that point. But, we thought that because he was guaranteeing to buy some and having got the mono ones developed, we put Arthur Quinn on to developing a stereo one (Macintosh, SQN, 2015).

It is clear from this quote that SQN had no existing plans to build a stereo mixer. Stereo television had not yet been launched in Britain, making research into stereo-capable products a significant risk for a small company like SQN. However, the involvement of Thames Television brought about the development of the SQN 4, while minimising risk for SQN due to the guaranteed purchase of a large number of units. Within the technological framework of broadcast television, large organisations such as Thames would have been preparing for the launch of stereo sound long before its eventual roll out. By extending this knowledge while simultaneously minimising risk, Thames were instrumental in the development of the SQN 4 stereo mixer.

Beyond testing equipment and making requests to manufacturers, there are examples of broadcasters being at the heart of the development of large technological systems alongside manufacturers. An example of this can be found in the development of digital post-production audio technologies and practices. Reports from the BBC Research Department have shown significant research into digital post-production as early as 1979 (McNally, 1979; McNally & Gaskell, 1985) and that internal development of techniques and equipment continued into the 1980s. This research eventually lead to the development of the BBC's own digital audio workstation named the Digital Audio Editor in 1987 (Kirkby and Gentles, 1990). The BBC

developed this system as a response to the shortcomings of commercially available systems, which were not properly attuned to the requirements of television production. However, the 1990 report suggests that, by developing the Digital Audio Editor, the BBC was not simply attempting to negate the need for commercial manufacturers, but was also mobilising its resources to better assess the feasibility of digital post-production in television:

> It was decided that a fully operational stereo editor should be developed to allow a wide appraisal of its potential. This would allow operational techniques to be explored and give a better understanding of the advantages and disadvantages of this approach...A major reason for the development of the Digital Audio Editor was to assess its capabilities in a broadcast environment (Kirby & Gentles, 1990, 1).

In 1991, the BBC once again turned to commercial manufacturers of digital audio workstations in order to work on the implementation of the AMS (now AMS-Neve) Logic 3 digital workstation at the BBC Post-Production Department. Logic 3 was a fully digital workstation based on the AMS Audiofile and the company's Logic series of all-digital desks. The Audiofile (See Fig. 15) had been available since 1984 and had found various but limited uses, including recording overdubs and triggering pre-recorded sounds in studio productions, at broadcasters such as Television South and post-production houses such as Twickenham Film Studio. However, a fully digital audio workflow for television post-production remained unattainable.

Fig. 15: AMS Audiofile DAW. (Image: AMS-Neve, 2017)

Logic 3 (See Fig. 16) was the culmination of a collaborative period that saw AMS, with guidance from the BBC, build upon their existing Logic 2 desk to incorporate the Audiofile and create a fully digital workflow that worked within the confines of post-production sound for television. In an article for *Studio Sound*, Rob James described the process of Logic 3's inception:

> In early 1991 a small group in BBC TV Post Production decided to re-examine the whole sound for picture process, starting with a blank sheet of paper. At the time, I was a dubbing (re- recording) mixer. Later, I managed the introduction of the process we designed...the Logic 3 (James, 2001, 24).

When interviewed for this research, James reaffirmed his belief that the BBC was instrumental in bringing AMS' innovations in digital audio workstations (DAWs) into the technological framework of television post-production. Despite the existence of the Audiofile, and a number of other DAWs which predated this collaborative period, James argues that this period was fundamental to the development of digital post-production sound in television because, before this time, such technologies had solely existed outside the framework of television production.

> “We produced a paper that was sent to 3 or 4 manufacturers who we deemed capable of delivering what we designed out of the clear blue sky. One of those was AMS, another one was Fairlight a third was New England Digital and the fourth was DAR Soundstation. The only two that came back with proposals were AMS and NED. A couple of projects engineers and I spent quite a lot of time commuting to Burnley for interesting conversations with AMS. As the Audiofile got better and it became more obvious what could be done with it and that in turn, with us pushing like mad, grew into the first comprehensive audio digital post production route[...]So that’s kind of the genesis of it and it was a very exciting and stimulating experience because we and the manufacturer were pushing each other and they were coming up with ideas[...]It was just a very creative process to arrive at a post-production process. So we were in bed with each other about as far as it’s possible to get. The only constraint was money and the budget was pretty damn generous anyway so we had a pretty free hand. ” (James, 2016)

When interviewed for this research, Mark Crabtree, founder and owner of AMS-Neve, confirmed James’ view of this period of innovation. Although AMS had developed the Audiofile and previous generations of the Logic desk prior to working with the BBC, Crabtree

states that the BBC was instrumental to the development of an digital workflow acceptable for the purposes of television.

> Working with Rob James and the BBC we eventually came out with Logic 3. We had the Audiofile and the control surface but with the BBC we worked out the work flows and the processes in detail. Rob James and his BBC colleagues visited frequently to oversee the process. Logic 3 was designed to the BBC's spec and to the BBC's timeframe (Crabtree, AMS-Neve, 2016).

This is a clear and significant example of the BBC having a critical influence over the development of a piece of sizeable technology (the Logic 3 system had a sale price of £80,000 in the early 1990s). As shown by the reports from the Research Department, the BBC expended considerable resources in its initial research into digital audio for television post-production. Through collaboration with AMS, the BBC extended this stock of knowledge and expertise in order to bring an existing technological artifact into the framework of television production. For AMS, this collaboration not only supplied knowledge, but also, once again, reduced risk and, therefore, catalysed innovation at this commercial manufacturer. Just as with the findings of Bijker (1989), Douglas (1989), and Sterne (2003), this is a clear example of a technological system only gaining traction once it has been brought into a technological framework in which there is sufficient demand, knowledge, and established practice to generate meaningful innovation.

Fig. 16: AMS Logic 3 DAW station, incorporating Audiofile (Image: AMS-Neve, 2017)

Advertising

Beyond instigating innovation and collaborating with manufacturers to realise development, big industry players, such as the BBC and the ITV franchises, had a secondary role in pushing industry-wide product acceptance. These organisations undoubtedly played a significant role in the widespread implementation of new technologies due to their size and industry status. As large unit buyers, these organisations had the power to propel a technology from development to an unofficial industry standard, as smaller unit buyers followed suit in their own procurement of new equipment. Of the manufacturers interviewed, almost all spoke directly about the role that large unit buyers played in pushing sales throughout the wider industry. The effect was so great that many stated that they did not actively advertise, instead relying on word of mouth and the status that being used by these dominant organisations bestowed, as Jim McAllister, founder of Black Box Video, described:

> It was all word of mouth, we didn't advertise, often they would see our stuff and phone us up saying, oh I saw this at so and so. It grew year on year on year. We sold a lot of stuff to the BBC and to the hire companies. Our first product, the BBC bought 17, which for us was a big order, so there was never any need to advertise (McAlistair, BlackBox, 2016).

This point was also stressed by Douglas Macintosh of SQN mixers, who directly attributes the widespread adoption of SQN to the fact that the BBC and ITV franchises bought SQN products in relatively large numbers:

> The BBC ordered about 40 of them and soon after they got them the ITV companies, who we had been working for for years and had contacts with and they certainly bought them and it just spread through British broadcasting like wildfire (Macintosh, SQN, 2015).

Similarly, John Gozzard, founder of Rycote, disclosed how, rather than advertising, Rycote also relied on the reputation it had ganered through purchases by the BBC in Britain and Disney in the USA:

> We never did any advertising or anything like that. Once the BBC got hold of them everyone knew about them anyway. We also got a big order from Disney so that really got them out there in America too (Gozzard, 2015).

While Black Box, SQN, and Rycote were, and still are, relatively small companies, this arrangement was also in place at the much larger company AMS-Neve. At that time, AMS-Neve had just been taken over by, and merged with, the engineering giant Siemens, and were already a massive industry name in post-production sound. However, in his interview, Mark Crabtree still stressed the importance of reputable buyers, such as the BBC, YTV, Thames, and TVS, for AMS-Neve gaining wider industry success:

> Early adopters were and are key to obtaining critical mass and the BBC had good buying power, but it wasn't just the BBC. YTV were enterprising, Thames were enterprising, as well as TVS. There was some resistance to the Audiofile because it was so cutting-edge and nobody had seen anything like it, that is why early adopters, like Rob James at the BBC, were so important. Also, as the BBC began to involve the indies more, they wanted to match the BBC format and so, in terms of spreading the Audiofile around London and Soho, having the BBC as early adopters really did do that (Mark Crabtree, 2016).

Clearly, manufacturers of these technologies felt very little pressure to advertise their products. The relaxed approach of these manufacturers clearly demonstrates not only the central role of broadcasters in the development and implementation of new technologies, but also the closed shop-nature of innovation within this industry more generally. By achieving implementation at a large industry player, such as the BBC or an ITV franchise, manufacturers were able to capitalise on the wider sales opportunities this presented without expending their resources, as smaller industry players followed suit. Undoubtedly, this aided in reinforcing the centrality of large broadcasters to the innovation process, as manufacturers saw these organisations as a way to achieve critical mass without expending considerable resources on marketing and advertising their products to the wider industry.

Patenting

The centrality and importance of broadcasters can also be observed in relation to patenting and intellectual property. Patenting has featured heavily in the histories of early sound and broadcasting technologies. Many scholars of this period (Wurtzler, 2007; Douglas, 1987; Sterne, 2003) have shown how patenting was a core business activity for those at the heart of the development of telephony, radio, and motion picture sound. Wider studies of technological development, such as Bijker's (1989; 1995) work on bakelite and fluorescent lighting, Hughes' (1994) work on the US steel industry and Van Der Belt and Rip's (1989) work on synthetic dye, again showed the important role of patenting in the development of new technological artifacts.

Wurtzler specifically addressed the development of early sound technologies:

> Industrial research and development represented sorties into the 'no man's land' of unexploited technological terrain, with patents fortifying newly established positions. Research could function preemptively, allowing a corporation to gain ground in as yet underexploited fields. Once such territory was gained the position and patents could be strategically surrendered...or colonized and transformed into economically viable new technologies (Wurtzler, 2007, 27).

This divided and highly competitive industrial environment meant that patents were used strategically to mark territory, speculate on future profit, and block innovation from elsewhere. The use of patents helped to solidify large scale corporations such as AT&T and General Electric as leaders of innovation, as it enabled their large research departments to amass extensive stocks of intellectual property even if it was not directly profitable to do so. However, the approach of manufacturers of television sound technology, an industry dominated by small firms, were vastly different to the approach of giant corporations, highlighted above, in the earliest years of sound transmission and recording technologies.

Intellectual Property (IP) law in the UK is extremely complex and has been an area of debate for over a century. While this thesis will not attempt to give any in-depth analysis of patent law itself, some interesting insights can be gleaned from the attitudes expressed towards patent law by the manufacturers interviewed. Protecting IP from would-be impersonators may appear a staple part of daily business for those manufacturing innovative and marketable equipment to an established customer base, such as large-scale broadcasters. However, for companies interviewed as part of this research, this has proven not to be the case, with many having spurned patents due to a number of contributing factors.

A brief summary of patenting shows that the fundamental premise of patenting in the UK is not simply that of a one-sided protective measure aimed at assuring the rights of the inventor and their ability to profit from their work. Since the Patents Act of 1883, patents have, in fact, been a balancing act in which the holder is granted a temporary monopoly (20 years) over the sale of their invention in return for the full disclosure, and public dissemination, of the details of the product under patent. This detailed sharing of information is regarded as the benefit gained by the public from the patent system and is the trade-off patent holders make for their twenty-year monopoly. The detailed information disclosed in the patenting process aims to help broaden public knowledge while encouraging wealth creation and employment (Bently and Sherman, 2014, 379; Aplin and Davis, 2013, 537; Bainbridge and Howell, 2015, 67). Bainbridge (2012) has stated that, for an application to be successful, disclosure "must be total with nothing of substance withheld [...] the holding back of part of the invention runs counter to the whole rationale of patent law and such applications will be rejected" (Bainbridge, 2012, 390). Bently and Sherman (2014) have also pointed to this as a potential problem for inventors, highlighting that the information disclosed can help competitors to "invent around the patent" (Bently and Sherman, 2014, 380). In addition to providing competitors with incredibly detailed descriptions of an invention, patent law in the UK, and the EU, also has the disadvantage that it is expensive to obtain a patent and, once it has been obtained, it is risky and expensive to pursue potential infringers (Bently and Sherman, 2014;

Aplin and Davis, 2013; Bainbridge, 2012). Bainbridge described litigation as a "notoriously expensive process" (Bainbridge, 2012, 386) and argued that:

> Obtaining a patent is expensive and takes a long time. It may be several years before action can be taken against an infringer. It could be said that the system favours large wealthy corporations which have the deep pockets required to acquire patents and defend them on a global scale. Unless the sole inventor can find a 'product champion', that is, an investor prepared to put up substantial funds, he will be seriously disadvantaged (Bainbridge, 2012. 385).

Through the use of statutory threat provisions (provisions aimed at stopping abuse of patent monopolies) infringers can, moreover, pose a serious hazard for patent holders. These provisions allow those accused of infringment to sue their accusers if they have been pursued wrongfully (as defined within the strict legal confines of whether or not the criteria for infringement has been met), meaning that the patent holder is not always in the position of power when attempting to protect their patent. These provisions add an extra layer of risk to an already expensive and lengthy process and, as Smith and Montagnon (2005) have pointed out, make patent holders less likely to make legal 'threats' to potential infringers.

Clearly, patenting an invention is fraught with challenges and disadvantages that must be weighed against the eventual benefits of obtaining a patent. Reflecting this situation, many interviewees stated that, in their view, patenting was a waste of precious resources, due to both the extreme cost and time taken up by the process and the general disadvantages of fully disclosing the details of their invention. Douglas Macintosh stated that, as a company SQN, did not patent any of their designs, despite the fact that in so doing, they did attract potential imitators:

> We didn't patent a thing, not a thing. It did lead to certain things getting copied, there were firms in America where they actually gave one of our mixers and our service manual to a couple of moonlighting designers, who then produced a sort of plastic version of our control knob. It didn't look as nice and didn't pose any real threat (Macintosh, SQN, 2016).

Not only did Jim McAllister also point to the financial and logistical pitfalls of patents, but also stated that Black Box Video doubted the effectiveness of copyright law to protect electrical equipment:

> We never patented anything, no. It wasn't worth it. You can copy something with just tiny, tiny little changes and then say it's not the same. [With] Electronics you can change things so slightly, change a resistor for another resistor, and claim it's not a copy. It's totally pointless, it just costs money and takes time (McAllister, Black Box Video, 2016).

John Gozzard of Rycote strengthened this argument:

> I didn't patent anything because they were too expensive and not worth the paper they were written on. We just didn't have the money for that sort of thing (Gozzard, Rycote, 2016).

While it could be argued that these companies chose to forgo patenting due to their relatively small size, patents were also regarded skeptically by Mark Crabtree of AMS-Neve, a big player in the world of sound equipment. Like the other manufacturers interviewed, Crab-

tree questioned the effectiveness of patenting and stated that AMS also chose to forgo patents for the most part:

> We patented a few things, but the problem with patenting is that it can actually give a leg up to the competition, change a few capacitors or things like that and you're usually off the hook (Crabtree, 2016, AMS-Neve).

This thesis is not, of course, an exhaustive study of patent use in sound equipment manufacture in Britain. However, the findings of this research do clearly indicate that working in television sound equipment manufacturers did not routinely patent their inventions. While the cost and questions over effectiveness are, of course, significant factors as to why this was the case, this common practice is also indicative of the wider ethos of the television equipment market in the UK. These manufacturers produced high-end elite technologies (elite in the sense that they were not domestic technologies and were tools used by a specific small social group) and operated in a tightly knit and insular industry in which there was significant diffusion between manufacturers and broadcasters. Clearly, within the broadcast industry, and its affinity for industry-standard technologies, reputation was the manufacturers' most significant asset for the sale and protection of their products. Broadcasters, with their significant budgets and resources, had the ability to push industry-wide implementation of new production tools, setting the standard for the wider industry. The role of broadcasters in this relationship impacted on the work of manufacturers, which enjoyed significant success and reputation growth if selected by a broadcaster. This is clearly supported by the fact that many manufacturers (almost all of those interviewed) chose to disregard what are normally seen as standard business practices, such as patenting inventions and the marketing and advertising of their products. Furthermore, this indicates the level of confidence manufactures had in broadcasters to bolster their business, both directly and indirectly, as none interviewed expressed any concerns at their lack of advertising or non-existent IP protections. It also demonstrates how fully embedded broadcasters were, not only in the development of technologies, but also in the culture and ethos of the entire industry. For the companies involved, large vertically

integrated manufacturers, and the reputational gains they provided, removed the need for them to pursue more professionalised business practices in what was an insular and elite industry. In short, broadcasters provided an environment that allowed manufacturers to act in a certain manner that may have otherwise been untenable. Without the existence of these large well-resourced vertically integrated broadcasters at the centre of the industry, manufacturers may have had to pursue tactical business practices far more seriously.

As we have seen in the findings discussed above, vertically integrated producer broadcasters played an instrumental part in the manufacturing of television sound equipment. Not only did they use their massive resources to directly instigate and intervene in innovation, but they also had the power to propel innovations from development to near industry-standard status. The status bestowed upon manufacturers through the adoption of a product by these organisations also clearly had a significant impact on their business practices with regard to marketing, selling, and protecting their products.

The Role of End Users in the Era of Vertical Integration

So far, the primary research discussed in this chapter has focused on the operations of manufacturers and the engineering departments at relevant vertically integrated broadcasters. However, as discussed in an earlier part of this chapter, users of technology constitute a significant social group within the innovation process for technological artefacts. Bijker (1995) discussed what he calls “inclusion” in a given technological framework and how it affects those in a particular social grouping and their contribution to innovation. The extent to which a social group is included in a technological framework reflects the degree to which it shapes their experience and contribution.

In vertically integrated broadcasters, operators of sound equipment experienced very high levels of inclusion. As mass employers and trainers of operational personnel, broadcasters shaped the experience of their operational staff in the context of the technological framework of broadcast television. Shared training experiences, the collaborative working environment, and the highly established knowledge and practices of operational staff worked together to engrain the technological framework into their working lives. Furthermore, an important role of broadcasters was to integrate users of technologies directly into the process of innovation. By including end users into research and development processes, broadcasters allowed end users to directly shape the outcome of innovation.

Multiple end users spoke of their interactions with manufacturers, either directly or through other departments. Interviewees perceived their role in this process as both important and influential, one OB sound supervisor commented on his experiences:

> We were always very favourably looked at by Sennheiser and vice versa. They often brought us a lot of stuff and asked us to try it out for them. The BBC as a whole and OB in particular were always working with Calrec for example, and others, who asked "Can you try this out for us and see if it works?" It was always quite nice to be at the front of technical development, OBs sort of got a name for it and we were certainly involved (OB Sound Supervisor 4).

Another OB sound supervisor added to this, again describing the perceived importance of their role in the design of a new communications system despite being in an operational role:

> For a great period of time, if you went to a manufacturer or to a trade show, even just mentioning that you worked for the BBC meant you were held in high regard. As a result, there was always a lot of interchange between us and the manufacturers to get what we wanted. We had to write the book and tell them what we needed, what had to happen and what shouldn't happen, the exchanges could be quite lengthy. As an example, we worked with a company called Drakes. They were into communications but nothing on the scale of what we wanted. We went on to devise a sophisticated comms system with them, which subsequently went on to form the basis of their later models (OB Sound Supervisor 2).

A location sound recordist recounted their experiences of the more day-to-day experiences with the introduction of new kit:

> You had your standard kit, but often somebody would say 'oh a manufacturer has come up with this, would you like to go and try it', so you would and you'd give some feedback. It wasn't always like that though, sometimes they'd say 'oh we've got one of these for every recordist' and sometimes you'd think, what on earth have I got this for (Sound Recordist 7).

Discussing the role of operational staff in the development of the Logic 3 system discussed above, Rob James supported the stance that the eventual end users, dubbing mixers, were at the heart of the development process:

> It was being driven by the people who used it. So it was not imposed in any way shape or form. It had been developed by the people doing the job and indeed the engineering people. We would take those ideas and bounce them off operational people, including me, but others as well, and that in turn generates new ideas. We [management] said to them 'hey guys how can we improve this process, what would you like to see?' and it grew out of that process (Rob James, 2015).

Reports from the BBC Research Department have also illustrated the centrality of end users in the innovation process. A 1990 report on the BBC's Digital Audio Editor shows that consultations with end users played a pivotal role in the design process and even led to certain designs, including mouse and keyboard-operated designs, being discarded:

> The results that are attainable have impressed all who have come into contact with it. A period of use convinces most users the future of audio production certainly lies with equipment of this type[...] Further experience with the desktop editors has confirmed that users are unhappy with the approach of using a mouse and graphics display. Here there is a very strong preference for the reel rocking facility (Kirkby and Gentles, 1990, 8).

Yet another example of the integration of end users into innovation processes comes from a 1991 report on the design of an umbilical cord for use with SQN 4 mixers and Betacam videotape, thus allowing for monitoring off the tape itself. Although it was a relatively minor development, the report directly stated that:

> During the whole development period advice was taken from the senior cameramen and recordists who would ultimately have to use the umbilicals. The result is not a compromise but a combination of the best ideas into a practical and robust system (Mortby, 1991, 2).

Clearly, the views of those working in operational roles at vertically integrated broadcasters were of value during the negotiations over the development and testing of new equipment. However, it is important to note that these arrangements and processes were also a source of considerable frustration for end users. The protracted bureaucracy of broadcasters at the time, particularly the BBC, meant that getting access to new equipment was a slow and intensive process. Furthermore, individual operators found it difficult to instigate the procurement of new equipment on an individual basis, as it was BBC policy to purchase *en masse*, meaning that 'off the shelf' solutions were rarely purchased. Instead, the BBC either favoured being involved during the development of a technology or opted for extensive modification following its stabilisation. Many interviewees spoke of their frustration in dealing with the Planning and Installations Department (P&ID), which oversaw the integration of new technologies into the inventories of individual departments. They pointed to the timescale of these processes, often lasting many months, as a particularly limiting factor on their ability to choose their equipment quickly and efficiently as individuals, as one location recordist described:

> There was at least a 7-8 month delay between requesting something and actually having it to use. P&ID almost became like a code. If someone said it's with P&ID you knew you wouldn't see it until next year (Sound Recordist 2).

One OB Supervisor built on this statement, not only commenting on the length and complexity of these processes but also commenting on the friction existing between operators and those in charge of purchasing and testing new technologies, labelling them as the "eagle eyed people of P&ID":

> [To get new equipment] You had to go through PID, they had an engineer that effectively looked after OBs and made recommendations to the director of engineering, because we were still under the engineering banner, to purchase equipment and then they would effectively buy it and pass it on to you. But making a bid for outside equipment, the equipment had to pass the eagle eyed people of PID and research department. It could go on for ages. A year wouldn't be unheard of. I remember a time when we wanted some new tape machines in the scanners and they were bought, but then they had to be modified and that modification process took time (OB Sound Supervisor 6).

A further location recordist discussed how the bureaucracy and hierarchies at play within these processes actually acted to demotivate them from actively pursuing the introduction of new equipment:

> I was aware of new equipment coming onto the market but thought there's no point getting too interested in it because the BBC will never buy it unless they're buying 50 of something. They wanted to standardise equipment for everybody, and so most people were happy with their lot and used the equipment they were given....They didn't buy things off the shelf from the manufacturer and give it to the sound man, it had to go to the procurement department and then it went to a department called P&ID which would test the kit and, if they didn't like it, they would actually modify it to the BBC's specification. It had to go through a testing procedure, be authenticated and then have a trial period. It could take 6 months to get through the systems, so there was no great incentive for people like myself to look around and say 'oh I like that piece of kit, I want that (Sound Recordist 1).

Evidently, the same characteristics of vertically integrated broadcasters that brought end users more closely into the innovation process worked against end users when trying to act quickly and flexibly. The processes that put both the BBC and end users at the heart of development, such as testing, trialing, and adapting technologies, acted to obstruct the purchase of generic, or 'off the shelf' equipment, as this acted against the BBC's wider policy, discussed earlier in this chapter. This obstruction of individuals' access to new pieces of equipment in which they may have been interested was clearly a frustration for those in operational roles. More significantly, these processes demonstrate that, despite the agency of end users within the innovation process, hierarchies within these organisations were still clearly at play when introducing new equipment. In the relationship between end users and the P&ID, it was clearly P&ID that occupied the position of power when an application for new equipment was put forward. While many of the comments made by end users regarding their role in the development of new equipment may portray end users as having considerable influence in these processes, it is important not to completely dismiss the inherent hierarchies existing

within large vertically integrated organisations. P&ID and these accounts of its relations with end users are a clear example of these hierarchies in action. However, this does not fundamentally devalue the fact that those working in operational roles experienced high levels of inclusion within the technological framework established by broadcasters and, by extension the innovation process. With innovation and large organisations inherently nuanced in terms of process and concept it was still possible for those in operational roles to experience significant inclusion in these process, despite the fact that hierarchies undoubtedly existed and were operating within them. For those interviewed, this inclusion was significant and meaningful, with their contributions playing an important part in the development of many technologies. The high level of inclusion within this framework also constituted an important part of their working practice and professional identity. Many interviewees spoke with pride of their influence on both their engineering colleagues and external manufacturers, as demonstrated by comments such as "we had to write the book and tell them what we needed". The significance of this inclusion is also reflected outside of the operators' own recollections. Rob James, former Manager of BBC Post-Production seems to consolidate this view in his recollection of the development of the AMS Logic3 System, as do a number of technical reports. The extent to which user influence really was meaningful in pushing innovation can never be fully ascertained. However, what is clear is that for end user sound operators in this era, inclusion in research and innovative processes was viewed as an important aspect of their work and added to their professional identity. This is clearly demonstrated not only by the way in which individuals spoke of these experiences, but also by the consistency with which interviewees broached the subject.

Open Innovation in Freelance Television Production

> The once broadcast-specific and pioneering research and development provided by organisations like the BBC and the old IBA is now deemed an unnecessary expense by most broadcast organisations, and future technological development is essentially now left to the commercial whims of the manufacturers (Robjohns, 2010b, 1).

Societal shifts and corresponding technological trends in the latter decades of the Twentieth Century have had a profound effect on the UK economy and its constituent industries, with television production being no exception. Those interviewed for this research from both manufacturing and operational roles stated that the development of sound technologies in television is now fundamentally different from the era of vertical integration. Significantly, television sound operators now feel less integrated into the development process and their professional identity as agents of influence on innovation is now considerably reduced. The manufacturers interviewed further strengthen this argument when discussing innovation and their struggles to connect meaningfully with users in the now dispersed and disconnected television industry. As shall be discussed below, a multitude of intertwining factors have led to this new environment of innovation and the perceived reduction in sound operators' agency in the development process. Foremost among these factors is the movement of Western society toward what Castells (1996; 2001) has called "the network society". Correspondingly, the reengineering of British television away from the vertically integrated broadcaster model and wider changes in innovative practices in the network society have played a substantial role in the shift described by Castells. Finally, the now complete ubiquity of digital and computer technology, as opposed to traditional electronics, in 'new media' production technologies has changed the way operators view their ability to contribute to the development of technology.

Castells described how, in the latter parts of the Twentieth Century and the early Twenty First, societies in the Western world fundamentally restructured themselves toward the network society model. While the preceding decades of the Twentieth Century were characterised by large-scale industrial activity, Castells argued that society has now entered into the informational stages of development. Using digital communications technologies ushered in by the "information technology revolution" (Castells, 1996, 13), both economies and wider societies are now structured around innumerable connected networks (Castells 1996; Castells, 2001; Murphie & Potts, 2003). As a result of this new technological and organisational model, the vertically integrated organisations that dominated much of the Twentieth Century have now appropriately restructured towards a flexible production system. While large corporate entities have retained their status at the centre of this new economy, the vertical integration-based organisational structure is no longer the dominant model, as Castells described:

> We are indeed observing the crisis of the traditional corporate model of organisation based on vertical integration and hierarchical functional management: the 'staff and line' system of strict technical and social division of labour within the firm (Castells, 1996, 156).

Clearly this new model of corporate organisation has implications for the research, development, and innovation process. With regard to innovation, Henry Chesbrough (2003) put forward the theory of "open innovation". Although not referencing either Castells or the network society directly, Chesbrough did argue that, in the latter part of the Twentieth Century, innovative practices shifted from the "closed innovation" paradigm to a paradigm of open innovation. According to Chesbrough, closed innovation is characterised by the well-funded and expertly staffed research and development departments of large industrial entities. At the heart of the closed innovation paradigm is the vertically integrated organisation, which makes large investments with long-term goals. However, in recent years, the boundaries of large companies have become increasingly porous (Wallin and Krogh, 2010). Innovation is no

longer the exclusive pursuit of vertically integrated corporations, due to factors such as increasingly skilled and mobile labour, the widespread adoption of communications and information technologies, and increased investment in small firms. As Chesbrough stated:

> Companies must structure themselves to leverage these distributed pools, instead of ignoring them in pursuit of internal R&D agendas [...] expertise is readily available for hire and need not require extensive internal training or the inducement of lifelong employment (Chesbrough, 2003, 41-49).

As shown by Dahlander, L and Gann, D (2010), open innovation has become a much used concept in the disciplines of management and organisational studies. Significantly, Laursen and Salter (2006) used data from the UK Innovation Survey to explore the application of open innovation in Britain. Incorporating the concepts of breadth and depth into that of open innovation, Laursen and Salter found that UK firms that are more open in their activities were statistically more innovative than those that are less open. Furthermore, Christensen, Olesen, and Kjær (2005) discussed the shift to open innovation in the early stages of the development of audio amplifier technology, a process now driven by numerous smaller dispersed and yet connected firms. Christensen, Olesen, and Kjaer do argue, however, that once a technology attains stabilisation status, this level of openness is vastly reduced.

This shift to open innovation has occurred alongside significant global trends in trade and exports. Castells showed the increase in the global trading of manufactured goods as a proportion of world productivity, rising from 15.3% in 1973 to a projected 28.5% in 2000 (Castells, 1996, 107). Globally, during the latter half of the Twentieth Century, the wider global trading of goods grew 27 fold and reached a value of $13 trillion, or 42% of the world's combined GDP, and continued to rise year on year by 9% up to 2004 (Shenkar & Luo, 2008; Hamilton and Webster, 2009; Buckman; 2005). Despite these figures, global trade is still dominated by the triad (Ohmae, 1985) of trading blocs (the EU, NAFTA, and Japan accounted for 50% of global trading in 2007). Within these trading blocs, the vast majority of trade occurs on a regional, rather than global, basis (Rugman, 2002). However, the UK, in

particular, has continued to lag behind its competitors, most notably the US, France, Germany and Japan, in terms of productivity, the measure of output to hours worked, and domestic investment (Balls, Grice, & O'Donnell 2004; Nachum, Jones & Dunning, 2002). Furthermore, research shows that, in Britain, research and development spending, historically low compared to its competitor, fell further throughout the 1980s and 90s, partly as a result of policies championed by the Conservative government of the time (Van Reenen, 1997; Balls, Grice, & O'Donnell 2004).

The effects of these economic changes to UK industries are wide-ranging and extensive. The UK economy is now dominated by the services sector, bolstered by financial services and insurance, which makes up 80% of the UK GDP (Office for National Statistics, 2017a). Traditional sectors, such as manufacturing, which saw a significant decline in the latter half of the Twentieth Century, have had to diversify and restructure in order to maintain their competitiveness in an increasingly global marketplace. For example, industries such as coal mining and, to a lesser extent steel production, have all but ceased in the midst of this new economic structure. The closing of the Kellingley Mine in 2015 saw the end of deep pit coal mining in the UK, due to an inability to compete with cheaper imports, new technologies, and restricting regulations (Jones, 2015). Steel production is yet another example of an industry that has seen fundamental change as a result of this economic restructuring, with steel production in the UK falling by two thirds from 1972 to 2014, again, in the face of cheap imports, a reduced manufacturing sector, and environmental regulations (Steel UK, 2017). Clearly, for traditional industries to continue to function in this new economic backdrop, significant adaptation has been required.

As with the industries discussed briefly above, the broadcasting industry in Britain had to adapt extensively and rapidly in the face of deregulation, competition, and new forms of production and delivery. Over this period, the industry reengineered itself away from vertically integrated producer broadcasters, a model which maintained significant pools of full-time permanent staff, and toward latent organisations reliant on an informal casualised workforce (Starkey, Barnatt, & Tempest, 2000; Storey, Salaman, & Platman, 2005, 1040). Gillian Ursell

(2000b) has shown that, during the late 1980s and early 90s, the BBC and ITV laid off 33% and 44% of their workforce, respectively. Of these lay-offs, production roles saw the biggest losses, amounting to 80% of the total redundancies (Ursell, 2000b, 757). Georgina Born (2004) also assessed employment numbers during this period and suggested that, while, in 1980, the vast majority of television jobs were at vertically integrated broadcasters, by 1994, freelancers had become the majority in the industry. As former vertically integrated broadcasters shed their once large pools of full-time production staff, they relieved themselves of the responsibility to provide, maintain, and replace the equipment that these employees required to carry out their duties. With little or no full-time production staff to service, engineering departments within these broadcasters, particularly the BBC, were downsized. Anecdotally, the number of publications by the BBC Research Department listed on their website illustrates this downsizing. From 1960 to 1970, there were 601 published research department reports, a number which fell to 420 between 1970 and 1980 and plummeted to just 141 by the 1990s (BBC R&D Search, 2017). It is doubtful that these figures represent the full extent of the work of the BBC Research Department, and, of course, they solely represent the content that has been successfully preserved and digitised. However these figures are in keeping with statements made both in the interviews undertaken as part of this research and in the wider trade press. Hugh Robjohns argued, in the run up to the closing of the BBC's Kingswood Warren engineering centre, that:

> The boffins were regularly exploring and refining technologies and concepts years ahead of their practical application in the BBC and as much as a decade before they became commercially available. In recent years I understand R&D work was only undertaken if it had a clear commercial value in the short term, and Kingswood Warren itself will be closed imminently ending a long and proud era...And it's not alone in its demise similar cut backs and reorganisations are occurring in broadcast organisations all over the world (Robjohns, 2010b, 1).

When employed by broadcasters, sound operators would have been provided with all necessary equipment, usually in the form of standard issue kits, and provisions would be made, by their employer, to maintain and upgrade equipment when required. In the freelance environment, however, operators are solely responsible for sourcing and paying for their equipment, and must make important decisions on purchases that represent significant capital spending to a freelancer. Operators interviewed as part of this research stated that the move to freelance working, and the subsequent removal of big broadcasters from interacting with manufacturers, has had a significant effect on their perception of their own power in the manufacturer-user relationship. Interviewees view themselves as having less power to influence manufacturers in the freelance environment, despite their increased personal investment and the risks they have taken. Furthermore, they view manufacturers as less perceptive and less willing to engage with end users, due to the fragmented and disorganised environment in which these users now operate. In their view, their ability to influence manufacturers and have a significant impact on product design has reduced significantly since the loss of their shared employers and the collective representation that these employers provided. Multiple interviewees argued that they no longer feel that they lead developments in technologies, with, instead, new technologies in fact imposed upon them by manufacturers. As one post-production manager stated:

> [User input is] Reactive as opposed to leading from the front. It's gone from absolute bespoke at the BBC to, if we're lucky, manufacturers incorporate some of those changes as they see fit (Dubbing Mixer 3).

One dubbing mixer, despite working at a large London-based post-production house, stated that technology, particularly software, is released on a "take it or leave it" basis with little regard for user feedback, he stated:

> You do occasionally see people from representing manufacturers, they come down here and talk to people, we've had people from Avid here recently, but it does seem much a case of here's what we've made, take it or leave it and, of course, we have to take it, our clients expect the very latest stuff. We upgrade our Pro Tools software every 18 months to make sure we have the latest (Dubbing Mixer 5).

This sentiment is echoed by a former BBC sound recordist:

> Im sure they [manufacturers] do ask some recordists what they want but, on the whole, it seems a case of manufacturers releasing kit and saying 'take it or leave it (Sound Recordist 6).

Furthermore, some interviewees talked about this in direct relation to new employment arrangements and industry organisation and how the absence of a large-scale employer has impacted upon their ability to make reasonable demands, one OB sound supervisor stated:

> If broadcasters were buying a lot of equipment from a manufacturer, they had a great deal of say on the specification. That's a lot more difficult to organise in the freelance world, it's almost impossible to arrange with freelancers. What are you supposed to do, get them to meet up in their free time? When staff were involved, it was much easier to get together and talk about things (OB Sound Supervisor 3).

Another interviewee built on this argument, and stated that it was not only harder to foster relations with manufacturers, but also that any feedback they do give may be viewed less seriously, as they are no longer affiliated with the BBC and its reputation and credibility:

> When I worked for the BBC, manufacturers wanted our feedback as it helped them make better products and, in fact, manufacturers valued those relationships with organisations like the BBC because it bought not only user feedback but user feedback of a certain quality, because they trained everyone well. Now our industry is much more fragmented and freelance, manufacturers don't necessarily have those same relationships and links anymore (Dubbing Mixer 6).

It could be argued that such recollections exaggerate the power wielded by these end users in vertically integrated broadcasters and are distorted by the inherent difficulties involved with memory. However, evidence of this change in relationships was not limited to end users. Numerous accounts of this shift are apparent in the statements made by manufacturers during interview. Simon Davies, current Managing Director of Rycote, argued that, in the freelance environment, creating meaningful relationships with customers can be difficult due to problems of access, even for a well-established industry name such as Rycote:

> Freelancers are great but, as they are all split and fragmented, it is hard to get access to them and, of course, instead of having one voice coming back, we have 20 and they can often be saying different things (Simon Davies, 2016).

Rycote is an example of a manufacturer that used to work closely with broadcasters, relying on them to foster relationships with end users, and which has now found this practice no longer fit for purpose. Davies argued that, in Britain, the shift away from vertically integrated broadcasters has changed the way Rycote conducts research and development. Significantly, Davies pointed to other large-scale production and broadcasting companies such as

Japan's NHK and the Formula One Group, which provides the outside broadcast facilities used for Formula One racing, as organisations with which Rycote still maintain relationships of a similar function to those maintained with the BBC in previous years:

> If you look at NHK, they are like the BBC of 20 years ago, and we do a lot of work with them, big time. The BBC however, they don't, for example, do OBs anymore, it went to SIS and then I'm not really sure who. We do work with big OB companies, like the F1 group, and we do a lot for them and it helps us with development, because, if it can take being put up and stripped as much as they do, it should be fine for others (Simon Davies, 2016).

During his interview, Davies revealed that Rycote had, in recent years, implemented a customer research and development strategy that was far more structured and organised than what had been described by previous interviewees as existing in the era of vertically integrated broadcasters. Using small business grants made available by the government for research and development, Rycote hired a consultancy firm to conduct customer research on its behalf, which featured relatively standard market research tools, such as questionnaires, surveys, and mystery shopping. This is clearly an example of the shift towards open innovation described in wider studies on innovation. Unable to rely on a centralised uniform customer base, Rycote has deemed it necessary to invest in a more outward and open form of research.

The notion of fragmented customer relations and the issues that this can pose for product development was also discussed by other manufacturers. Oscar-winning equipment designer Chris Woolf, echoed the views of Dubbing Mixer 2*,* questions the extent to which these relationships can be practically maintained in the freelance environment. Similarly to the 'grammar of production' discussed in the previous chapter, Woolf argues that, with training now considerably different to that previously offered by the BBC, end users no longer speak 'the language' of manufacturers in the way they did in the era of vertically integrated broad-

casters. Due to this, Woolf argued, user feedback becomes an exercise in general fault-finding rather than specific, detailed, and achievable demands:

> That doesn't happen anymore, nobody has any clout. There isn't an engineering department anywhere that could specify anything, you take what's on the shelf and that's it. Manufacturers are now the ones setting the specs, not the customers, you just have to accept what's there. Even the IPS and organisations like that organising meetings between manufacturers can't really achieve very much, they just don't have the clout [...] With an organisation like the BBC, they could really get in early in the development stage, with trained engineers and operators who spoke the language, and could make changes and have an effect on the outcome and manufacturers liked that, they welcomed it. When you get feedback from users now, they often don't know what they're talking about [...] We have people Beta testing stuff sometimes and we're always very wary. I think a lot of companies are wary of beta testing and getting things out there initially, because you might have 20 people beta testing and so you might end up with a dozen 'great ideas' of what it could or should do. But, I don't want people's ideas, ideas are 10 to a penny [...] What beta testing is supposed to be about is the little details, does this screw rust or does the rubber wear out, the last thing I want is people's big ideas (Chris Woolf, 2016).

The notion of the multiple, varied and often superficial instances of feedback received by manufacturers from freelancers is touched upon by further interviewees involved in equipment manufacture. Joseph Parys, the current owner of SQN mixers, has stated that, despite often getting requests for a digital version of their SQN mixer, these requests are sporadic and do not include any technical specifications or requirements that potential users would value:

> Every week probably we get a message just saying ‘make a digital recorder’, without suggesting any sort of specs or features so that’s not much use. Once a month, we might get specific mixer requests by people who know their stuff and know what they want, but they are few and far between (Joseph Parys, SQN, 2016).

These comments made by interviewees on both sides of the “line of implementation” (Leonardi, 2009; Orlikowski 1992) show that both parties feel that creating meaningful and productive relationships between manufacturers and end users is now increasingly difficult in the decentralised production industry. Freelancers are too fragmented and lack a coherent voice and strategy when trying to influence or make demands on manufacturers. As a result, end users increasingly feel as if their voices are minimised and that they now experience innovation as largely something that is imposed on them and over which they have little control. For manufacturers, the new freelance economy of television production makes it much harder not only to gain access to end users but also to interpret and act upon the incoherent feedback of many independent customer voices. Furthermore, this feedback often does not comprise same standard of detailed and thorough technical suggestions received in the days of vertically integrated broadcasters with large engineering departments. As discussed in the previous chapter, the training available to individuals in the industry is now significantly different. As a result, the ability of end users to ‘talk the language’ of innovation has changed accordingly. Manufacturers used to deal with highly skilled technically literate operators, who could provide detailed analysis of equipment and make structured objective suggestions. However, manufacturers are now often faced with end users without a technically focused training and, consequently, less able to provide such detailed feedback. Clearly, innovations in sound technologies in television production have occurred, and will continue to occur, since the reengineering of the television industry in Britain. This chapter does not suggest that these changes have stopped, or even particularly hampered, the flow of technological innovation, as new technologies will continue to be introduced into market as long as there is an industry which requires them. However, what is clear from this research is that the role that end users

play in this process and, thus, how they view their agency within this relationship are now fundamentally different to the situation in the era of vertically integrated producer broadcasters.

Manufacturer-User Relations in the "New Media Revolution"

Chapter 5 of this thesis will argue that those in operational sound roles have seen a decline in the importance of technical and engineering-based skills in their professional skillset. As technological affordances and the manner in which operators are trained have changed dramatically, so too has the skillset required to perform their job. The sound personnel of modern times are less inclined and improperly trained to know the intricate workings of their tools than they were during the era of analogue technologies. As miniaturised digital hardware and software able to run on standard domestic computers have infiltrated production, the tools of the profession are less open to operator 'tinkering' - a staple feature of the operator's job in the era of analogue equipment. However, significant to this chapter, interviewees expressed that this shift to digital also had implications for innovation and manufacture-user relations in the development of television sound technologies.

Yuzo Takahashi examined the importance of tinkerers to the development of radio and television in Japan arguing that, similar to those using sound equipment in Britain, users who indulged in tinkering were integral to fostering good relations between manufacturers and end users. Following the professionalisation of the industry, such users soon found themselves at the heart of innovation in Japan, working for large electronics companies:

> The culture of tinkering and the amateur entrepreneurship of the early Japanese radio and television industry helped create an electronics industry attuned to customer demands for quality and service […] Tinkerers, however, are people who can bridge the two worlds of consumers and producers (Takahashi, 2000, 473).

Similarly, Steve Waksman (2004) also examined the importance of tinkerers in the development of electric guitar design. For technologies that are founded in electromechanical engineering, such as those used in sound for television, "tinkerers" and hobbyists occupied an important role in innovation and development. However, in the 1980s and 1990s, digital technologies began to creep into the day-to-day operations of television sound.

Manovich (2001) has shown that while media technologies and computing had developed in parallel for almost two centuries, they converged absolutely towards the end of the Twentieth Century, in what Manovich called "a new media revolution" (Manovich, 2001, 19):

> The computer media revolution affects all stages of communication, including acquisition, manipulation, storage, and distribution; it also affects all types of media - texts, still images, moving images, sound, and spatial constructions...they simple comprise of another set of computer data (Manovich, 2001, 20).

Briggs (1995) discussed how, by the late 1950s, the BBC was already experimenting with the use of computer technology for managerial and administrative tasks, and that, by the 1960s, it had developed to the extent of incorporating tasks such as calculations and communications within broadcasting itself. By the mid-1970s, these technologies had started to gain traction at the BBC for production tasks such as controlling lighting consoles and computer graphics (Briggs, 1995, 820). As computers have become increasingly capable, they have subsumed

processes such as image and sound capture and storage, meaning that technologies for this purpose are now governed by principles of numerical representation, modularity, variability, and transcoding (Manovich, 2001).

As digital and computing technologies have infiltrated production technologies, and, indeed, almost all aspects of technology, they have fundamentally changed the basis of such technologies' componentry. As a result, the subsequent expertise required to design and construct such technology is now radically different. What used to be the work of electrical engineers is now the work of computer scientists and software developers. Equipment manufacturers of the past were dominated to by those with real world operational experience and a background in electronics, knowledge that was, at least to some extent, shared with the users of the technology. However, interviewees pointed to a disconnect between the current expertise of those working for manufacturers and that of those working as sound operators. While manufacturers have adapted their skills and expertise, a lack of corresponding adaptation on the behalf of operators meant they now have far less common knowledge than in previous decades and technological eras. Speaking of the difficulties of communicating with and making demands on manufacturers, one ADR recordist stated:

> I think now it's not really possible to have all of those skills, you'd need software engineering skill and a knowledge of sound, it's just a different type of person making kit now. I once met the team from Isotope [plugin developers], who were here for a tour or something, and they're all about 12, you know, really young computer guys (Dubbing Mixer 4).

One dubbing mixer also discussed this point, directly pointing out the lack of operational experience at many modern manufacturers:

> Nowadays, the technology seems to be being made by people whose background is computer science. They don't have a clue about mixing or sound design at all and, in turn, I don't have a clue about what they do (Dubbing mixer 1).

A former post-production manager at the BBC also noted this change:

> All the manufacturers these days are now effectively just software companies (Dubbing Mixer 2).

Evidence of this shift is not only present among interviewees who work in operational sound roles. Simon Davies, current MD of Rycote, voiced his concern about his ability to hire engineers with an appreciation of operational practicalities now that the BBC no longer trains a vast pool of engineers and operators:

> The conventional audio engineer doesn't exist any more and that's going to be a huge problem for us in 20 years when the BBC trained guys are retired. We're going to have to figure out how to face that problem of recruiting engineers but also connecting with our customers. But the basis of it has to be found in a love of sound recording, just being good at engineering isn't really enough (Simon Davies, 2016).

Chris Woolf, another equipment designer:

> We have to pay a lot of money to find people with a decent amount of engineering knowledge who also know sound and, of course, there are a lot of people fishing for them...It's very weak in this country, we are so stuck in our ways that science and engineering cannot go with the arts, it's horrific (Chris Woolf, 2016).

Jim McAllister of Black Box Video also touched on this predicament when discussing the attempted sale of the company, arguing that finding a buyer who fit the company was difficult because the traditional engineer-operators with a skillset composed of both technical and operational knowledge are no longer commonly found in the industry:

> We tried to sell up but we struggled to find the correct buyer...nowadays, there's plenty of people that know about electronics and computing, there's plenty of people who know about the industry, but very few who know about both very well (McAlistair, Black Box Video, 2016).

The following chapter looks in far more detail at the changing technological milieu in which sound operators now find themselves, and assesses how these changes affect operators' working practices day-to-day. However, as the evidence above suggests, these shifts have an effect beyond day-to-day operations and impact on how users now view their role in the development of new technologies. The identities of manufacturers and end users are now far more dissimilar than in previous decades. As manufacturers of sound production technologies adapt to the demands of digital and software-based technologies (or are replaced by companies more able), those in operational roles now feel more disconnected from those who develop their professional tools.

In addition to this growing disconnect in manufacturers' and end users' education and skills, a further factor ushered in by the "new media revolution" (Manovich, 2001) can be

seen as contributing to the apparent reduction in operator influence on the design of new production tools - the domestication of production technologies. As discussed above, the closed shop operating between highly resourced broadcasters and manufacturers has been severely disrupted as the industry has been restructured. Furthermore, as the UK economy shifted more generally as a result of characteristics inherent to a network society and embraced a culture of open innovation, firms have had to diversify and seek new consumer bases. As Manovich (2001) found, digital technologies and domestic computers have proliferated throughout society in the last three decades. As a result, manufacturers of tools traditionally used solely by elite groups, such as those working in television production, have discovered new groups of consumers to serve and new markets for the non-professional application of their products. Tarleton Gillespie argued that production technologies are now "made for and promoted to a wider consumer audience" (Gillespie, 2003, 119).

Numerous examples of manufacturers aiming to diversify so as to capitalise on this new market can be found among those who once exclusively made equipment for high-end professional uses. Pro Tools, the now-standard software used in music, film, and television post-production, is offered to students on a subscription basis for as little as £10.80 per month (Avid, 2017a). For non-student users, this price is still relatively low, at £27.60 per month if purchased on a rolling month-to-month subscription (Avid, 2017b). Both varieties of this software can be run on domestic computers and, when purchased via subscription, come with a host of "add-ons", including video tutorials and annual *Avid Advantage Support Plans*, which provide expert support both online and by phone. Avid's subscription access to Pro Tools and its other audio-visual software is a clear example of a professional equipment manufacturer attempting to serve a non-professional consumer base with products designed for domestic application. Furthermore, new products from Rycote, manufacturers of professional standard microphone windshields and suspensions, show evidence of an attempt to diversify and access new audio-visual markets after the reorganisation of vertically integrated broadcasters. The Rycote Micro Windjammer utilises materials from professional windshields to create a windjammer for use when filming with tablets and mobile phones (Rycote, 2017a), while the Rycote Mini Windjammer is a slightly larger system aimed for use with the internal

microphones of a range of small non-professional cameras (Rycote, 2017b). Furthermore, in the form of the Nucleus 2, Oxford-based mixing desk manufacturers Solid State Logic now offer an integrated interface, mixing desk, and DAW controller in portable desktop form. The Nucleus 2 connects to any computer via one ethernet cable, is compatible with numerous DAWs, including Pro Tools and Logic, and is intended for use in both music production and audio post-production (Solid State Logic, 2017). Retailing at £4,000, the Nucleus 2 still represents a significant investment for a hobbyist or freelance dubbing mixer or music producer. However, this price is still many times cheaper than many professional mixing desks and in line with many other low to mid-level control surfaces, such as the Pro Tools S3. The inherent flexibility of the Nucleus 2 further suggests that it is not aimed at elite professionals with a definite and well-established set of practices, and, instead, at those with multiple potential uses for the technology.

When interviewed, Mark Crabtree argued that AMS-Neve did not wish to enter into the development of consumer products, instead choosing to focus exclusively on the professional market:

> We operate at the top, we only sell to professionals and there is a line that we refuse to go below. We do some cheap stuff, you can get a 88RLB preamp for 600 quid and we go right up to a million dollars' worth of gear for a studio if that's what you want, but we never go below a certain point. Many people have failed trying to take professional kit to the consumer market and also trying to take consumer kit and make it professional (Mark Crabtree, AMS-Neve, 2016).

In this stated practice, however, AMS-Neve is the exception rather than the rule. Manufacturers of television sound technologies are now increasingly widening their consumer bases and increasingly entering into the domestic technologies market. As the technological

framework and closed shop provided by vertically integrated broadcasters has ceased to exist, manufacturers are now looking to other industries and consumer groups to bolster sales in the age of open innovation. When working for vertically integrated broadcasters, television sound operators enjoyed a high level of inclusion in the technological framework provided by their employers and, as a result, were at the forefront of technological development. As has been discussed above, they now find themselves a fragmented group increasingly struggling to present a united front in the freelance environment of television production. However, beyond simply this fragmentation, television sound operators must face being merely a single user group in an increasingly widening field of domestic and amateur consumers. While previous employers allowed for television sound operators to be the dominant social group, propelled to the forefront, manufacturers are now increasingly turning their attention to other user groups and potential sources of revenue.

Conclusion

When interviewed for this thesis, Post-Production Manager Rob James said that the BBC and manufacturers had been "in bed with each other about as far as it's possible to get" during the era of vertical integration (Rob James, 2016). The accounts of interviewees working on sound in the deregulated digital television environment show that this is no longer the case. In the decades preceding deregulation, broadcasters provided an established technological framework and fostered relations between the end user and manufacturers. Furthermore, by providing training with a technical focus, they injected a shared knowledge and 'grammar' into these processes. Broadcasters provided manufacturers with access to expert testing with consequently meaningful feedback as well as the assurances that came with large orders and significant industry status. For those in operational roles, broadcasters provided a platform, or at least the perception of a platform, to make meaningful demands of manufacturers and play a significant role in the development of new technologies. As the industry has morphed into being characterised by freelancers, casual employment with no centralised training, and reduced levels of R&D, those working in operational roles now feel less incorporated into the innovative process and view themselves as having less power to influence outcomes. While

manufacturers of sound technologies now actively conduct research and respond accordingly to the needs of their customers, this clearly does not resonate with those in operational roles in the same way as the interactions they formerly enjoyed as employees of large broadcasters.

Tinkering

This chapter offers an analysis of the changing practices of sound operators when going about their day-to-day work. The previous chapter analysed how industrial and structural reorganisation affected the role of sound operators in the innovation process. It also briefly alluded to how the increasing presence of digital technologies in production and the shift in training provisions further impacted on the end users involved in these processes. In the analogue era, 'tinkerers' played a significant role in the development of technologies, both within institutions and beyond. However, the role of such tinkerers has diminished in the innovation process as result of technological and industrial change. This chapter offers an account of how these industrial and technological factors have affected sound operators and their daily working practices recording, editing, and mixing sound for television. In doing so, this chapter builds on the work of Chapter 3 to show how technological developments have coincided with the reorganisation of industry training, contributing to the shift in how sound operators both interact with their tools and view their work and skills. It shall be argued that, as a result of these changes, operator 'tinkering', once fundamental to successful practice, has become a less prominent feature in the arsenal of professional sound personnel in the last thirty years. As briefly discussed in the previous chapter, digital technologies, both hardware and software-based, are now engrained in the tools and practices of television production. In addition to impacting on the process of innovation, the differing affordances and composition of these new technologies have had a marked effect on how operators interact with their tools on a daily basis. This change in interaction has had a marked affect on how sound operators now view their skillset and role within the production crew. Furthermore, as shown in Chapter 3, television has now moved away from the tradition of in-house training at major broadcasting organisations toward an environment dominated by university graduates. This change in training has contributed to a significant shift in the skills and approach that sound operators now possess and prioritise when embarking on their careers.

In this chapter, 'tinkering' is defined as technical knowledge and skills applied to electrical and mechanical devices in order for them to function at a level required for a professional sound operator. This includes professional duties and knowledge, such as the essential

maintenance of equipment, frontline repairs of faulty equipment on location and the making, modifying, and adapting of kit to meet unexpected or peculiar requirements the sound operator may encounter. While the operation of these tools remains a skilled set of practices, sound operators now rely significantly less on their ability to tinker in order to successfully conduct their work. Furthermore, sound operators can no longer use the knowledge and skills inherent in tinkering to portray a professional image as skilled craftspeople essential to production processes. As Chapter 7 of this thesis shall explore in detail, the ways in which sound operators cultivate value in their profession and define their work has been appropriately adapted. This chapter and, subsequently, Chapter 7 aim to show not simply a deskilling but a shift in the constituent skills that make up the 'craft' of sound recording, editing, and mixing in British television. Interviewees often cited other aspects of their work, such as communication, diplomacy, creativity, and ingenuity as being central to the successful completion of their work. As such, this chapter will discuss tinkering as only one component of the wider craft of sound personnel, one that is separate from many other important aspects of the job.

This chapter will build on Chapter 3 to analyse the extent to which technical knowledge and skills obtained from training featured in the daily practices of the sound operators during the era of analogue sound equipment. The discussion will then turn to analysing how the fundamentals of the professional tools of sound operation have changed, effectively locking out users from tinkering with equipment. Clearly, working practices and the skills that comprise them are inherently linked to the training and development opportunities available to sound operators. As a result, this chapter, and indeed most of this thesis, is inherently linked to the findings outlined in Chapter 3, and must be analysed within the wider context of those findings.

Technologies and Craft Production Roles

As shown in Chapter 1, themes surrounding production technologies' usability and the reshaping of production processes have featured heavily in production studies and wider academic work. While not directly addressing the engineering skill inherent in older production practices, this body of work shows that the characteristics and affordances of technologies shape the interactions and working practices of those using them. A clear example of this is the now common issue of deskilling in many production roles, due to the implementation of digital technologies aimed at streamlining production process and, ultimately, saving costs.

Deskilling and cuts to personnel as a result of new production technologies are identified by numerous scholars, most prominently in the form of multitasking, the use of multi-skilled operators, or stripped-down production processes. While few address the decline in any one aspect of workers' professional practices, such as technical skills or engineering knowledge, many do state that developments in increasingly user-friendly technologies have stripped many jobs of their overall requirement for skilled operators. This stripping of traditional skills therefore gives way to the rise of multi-skilled operatives completing the role of singular-skilled crafts workers. John Caldwell (2008), Cottle and Ashton (1999), and Casey et al (2008) all pointed to news gathering as a prominent example of a production process that has seen a substantial increase in the prominence of multi-tasking due, in part, to digital recording technologies. Meanwhile, numerous writers, including Mark Deuze (2007), Ellis (2012), and Beck (2008) have analysed the implications of new digital technologies on below-the-line staff in a variety of productions, job roles and industries. These accounts have almost universally illustrated how digital technologies, and the affordances they provide, are utilised as a means to disrupt traditional practices and streamline the resources dedicated to production processes.

In addition to the more general notions of deskilling and multitasking, a number of researchers have discussed the implications of new technologies with regard to technical skills and engineering proficiency. In her 2004 article *Engineering the Performance*, Susan Horning

wrote directly about the diminished role that engineering-based skills now play in professional music production. She argued that, due to the new technologies at the disposal of music studios and waning interest in hands-on mechanical skills among young sound engineers, the level of electronic and mechanical knowledge possessed by music producers has been significantly reduced. When discussing the the role of music sound engineers prior to the 1960s and 1970s, Horning stated:

> Even on the amateur level, making a recording once required enough electronic and mechanical proficiency to assemble or build equipment...There is much more technical proficiency required of the recording engineer (Horning, 2004, 705).

Horning went on to discuss how new technologies and the changing characteristics of the workforce within music production have eroded the prominence of these skills. As the professional identity of those entering the music industry has shifted away from what Horning calls 'tinkerers', the skillset that industry entrants possess has changed accordingly:

> With the advent of computer-based recording programs anyone with basic computer skills and the money to afford a studio in a box can make recordings of reasonable quality [...] The first generation of recording men were tinkerers and mechanical engineers [...] By the 1980s few young recording engineers knew how to open the black box [...] More often than not they got into recording because they wanted a career in music [...] not because they liked to tinker with equipment (Horning, 2004, 705-721).

This notion of engineering-based skills leaving professional production can also be found with specific regard to television production. Houseley, Nicholls, and Southwell (2001) argued that the type of people who were actively recruited into the TV industry were considerably different to those recruited in more recent times. They argued that, in the earliest days of television, engineering was the dominant background and interest of those entering televi-

sion production in an operational capacity, describing how many of television's earliest operators:

> Joined the organisation with an engineering career in view and, in the first instance, were not really interested in programme making as such (Houseley, Nicholls, and Southwell, 2001, 182).

Houseley et al went on to argue that, by the late 1980s, a combination of technical advances and the industrial shifts following the launch of Channel 4 meant that incoming recruits no longer required such technical knowledge to perform these roles, and that the professional image of operators as engineers became redundant:

> These factors shifted the requirement for broadcast companies to retain engineering skills within the firm. From an operator's perspective...The professional engineer has returned to the equipment manufacturers (Houseley, Nicholls, Southwell, 2001, 183).

Tarleton Gillespie elaborated on this argument, stating that, as digital production technologies have become household items, the tools of production are no longer restricted to the few working professionally in production. Subsequently, these new user groups have contributed to reshaping the tools of media production into a more user-friendly, less labour-intensive form:

> Where tools like these were once designed for users who very much resembled the designers, now they are made for and promoted to a wider consumer audience - and must resonate with users who do not consider themselves part of this technical design community (Gillespie, 2003, 119).

Clearly, for Gillespie, hardware-based digital production technologies, such as cameras and sound recorders, and easy to access software now ubiquitous in post-production, are no longer the tools of an elite group of highly trained professionals. As briefly discussed in the previous chapter, the manufacturers of these technologies have found new consumer bases, meaning the close relationships and shared knowledge among manufacturers and broadcast-specific users has dissipated. It is no longer a user requirement to share this technical knowledge with manufacturers or to possess a deep understanding of the workings of their tools.

Clearly, deskilling and the departure of engineering skills from production roles are a common occurrence in production environments, in both Britain and the US. This chapter will build upon this existing work to analyse the affects of new digital tools on the working practices of television sound operators, specifically with regard to technical skills and knowledge. It will argue that, while the term deskilling is inappropriate in the case of television sound, there has been a significant shift in the way that sound operators interact with the tools of their profession and the prominence and value placed upon certain skills within the production community. Of these skills, tinkering and the operator's ability to maintain and modify their machines have been removed from the armoury of skills and knowledge essential to the work of professional sound operators, and are no longer central to the professional identity of those working in these roles (see Chapter 7). Occurring over time, this change has been facilitated by new technologies that are both less labour intensive than predecessors and less ac-

cessible to operator tinkering. This chapter builds on the assertions made in Chapter 3 and gives a clear example of how changes in training have significantly changed the skillset of new sound operators and have reinforced this shift away from tinkering with professional tools.

Tinkering in the Analogue Era

> We were the Meccano age, the people who have been brought up mechanically fixing things [...] I've actually rewired a complete vehicle when the wiring burnt out, using microphone cable in Botswana once. We were in the middle of the Kalahari, but two of us managed to get it working (Sound Recordist 6).

In his research into the work of building maintenance technicians, Christopher Henke (2000) discussed how the practices of maintenance and repair are inseparable from the workplace in which they take place. Maintenance allows for workplaces to achieve a state of "normality" in which the established practices, norms, and processes can continue without interruption. The processes of maintenance and repair that facilitate this normality are, largely, conducted "backstage". Only when something goes wrong, thus disrupting the state of normality, do these processes shift from backstage to front-stage. In such instances, technicians are tasked with both repairing the material technical fault and restoring the "social order" to its normal state. Undoubtedly, for sound operators working in the era of analogue equipment, maintaining their equipment and therefore the status of normality in the wider production was a fundamental aspect of their work. As shown in Chapter 2, when working with analogue sound equipment, managing the vast arrays of complex and unreliable equipment was foremost in the minds of operational sound crews, with the failure to do so bringing their work from backstage to front-stage and causing personal embarrassment.

This focus on maintenance was, understandably, most notable in roles that involved work away from studios, such as location sound recording or outside broadcasts. Within these roles, an understanding of the mechanical and electrical workings of the machines were of paramount importance to ensuring that they were competent in completing 'first line' maintenance and repairs. This, clearly, was of great importance when shooting on location, wherein replacement kit could be difficult and expensive to source. First line maintenance is, of course, a vague definition of what these sound operators would be expected to perform. Data from interviewees reflect this vagueness, with interviewees often giving varying accounts of what tasks were included in first line maintenance. However, an internal memo sent in 1970 from an "Advance Maintenance Supervisor, Television Outside Broadcasts" to the Sound Manager and all Sound Operators outlines three 'headings' under which the operator's responsibilities fall:

> i. Lining-up and testing sound equipment to see that it falls within the required specification (i.e. noise, frequency response etc)
> ii. Diagnose faults to particular units and replacing of such units
> iii. Diagnosing and repair of wiring faults in the main body of major sound items (BBC Written Archive Centre, 1970).

While these guidelines were only issued to those working on outside broadcasts, they are indicative of many of the responsibilities expressed by interviewees working in wider production roles. These guidelines, although limited and open to broad interpretation, do give an insight into the knowledge required of those working in operational sound roles. Clearly, to complete such diagnostics work, those working in these roles must have possessed detailed knowledge of not only how to operate their machines, but also how they actually functioned and the precise workings of the individual components of any one piece of technology. Furthermore, the ability to rewire and solder any damaged parts are skills key to fulfilling point iii, as outlined above. Such wiring tasks would clearly require faulty equipment to be disassembled and reassembled, both quickly and accurately, while on location. This in itself would

take skill and experience to be carried out precisely and efficiently under pressure.

Beyond the evidence provided in the internal memo discussed above, multiple interviewees spoke of maintenance tasks as part of their professional practice in a way that displayed a high level of technical knowledge found in routine tasks, as one ex-BBC sound recordist interviewed stated:

> Away from base, all repairs were done by operators. In fact part of my selection process was to know which end of a soldering iron got hot (Sound Supervisor 1).

Another OB sound supervisor stated:

> In the 70s, things were screwed together and soldered and there were wires floating around so you could work it out...In the old days changing a capacitor or resistor if you could see one had burnt out, that would be something you could do on site. If you were away from base, you did whatever was necessary or whatever you could to make things work (Sound Supervisor 4).

Statements made by a location sound recordist interviewed also support this point:

> That was of prime importance because you needed to know how it works, not just to know how to work it, but how it works. I must admit I wasn't terribly good at it. I used to keep my supervisor entertained by him giving me stuff to solder. I'd keep him laughing for hours with my attempts (Location Sound Recordist 8).

The issue of technical skill and improvisation were also referenced during the filming of the Adapt Project's 16mm film simulation. During this exercise, the participating sound recordist discussed his experience working in a programme filming the Chicago Symphony Orchestra in less than ideal circumstances:

The director told me that he had been on a recce and there was an installation in the hall we could use and when we arrived it transpires that the installation in the hall that had been put in by a local radio company had never been finished. And they ran all the cables up into the roof by the lift shaft with disastrous results so they had abandoned it. Luckily, I had taken lots of cables with me, XLRs etc, as I didn't know what the situation was and we sat up all night making long microphone cables with a soldering iron, my assistant and I, and we tried to hire a mixer whilst we were out there and the only thing we could get were these, so I hired 3 of these and wired all 3 together so it obviously gave a lot more channels to feed into the Nagra. It was quite a hair-raising scenario, but we got there (Adapt Simulation Sound Recordist, 2015).

These recollections are not only limited to production sound, a dubbing mixer also touched on this point in her description of work, despite the clearly static nature of the work of dubbing mixers:

> Analogue desks could quite often develop faults, you could actually hear when, say, a capacitor inside went or something like that, and you would have to go along tapping and soloing each track to find which one had the fault. Once you found it, you could just remove the whole card and insert a spare one, we always had spares and you'd take the broken one down to the workshop to repair it and re-solder a joint or whatever it may be (Dubbing mixer 1).

In addition to the practical and logistical necessity of these skills and practices, one OB sound assistant discussed how the prominence of these tasks and the skills needed to undertake them shaped his identity as a sound operator. Echoing the sentiments of the Location sound recordists quoted earlier, he utilises the metaphor of Meccano to characterise his working practices:

> I was a pluggery man, it was like building a giant Meccano set, that was what I did. I say I was a sound man but I wasn't. I was more of a pluggery up and mending sort of bloke...In theory, you were supposed to send things back in a van [to the relevant engineering department] and get another one to replace it, but in real life that didn't happen, you had an hour to make it work, so you had to do something (OB Sound Assistant 1).

From these statements, it is clear that, in the era of analogue sound equipment, technical knowledge and maintenance skills featured heavily in the day-to-day working practices of sound operators. For those working on location, the ability to solder, as well as an understanding of electrical circuits and their components were among the most pertinent of these maintenance-based skills, as they aimed to work within the network of the wider production and maintain the backstage status of their practices. Almost all interviewees spoke at some point

of their experiences using soldering equipment in inhospitable conditions, with some going as far as saying that they would never leave for location without a soldering iron.

Beyond the practical necessity of this knowledge, these skills contributed to the professional identity of those working in these roles, and added to the inherent value of their work. Such skills did not simply comprise a mundane set of tasks that one must complete in order to fulfil the work, but were, in fact, a source of personal pride. This is clearly evidenced by the boastful recollections of the sound recordist who successfully rewired the crew's vehicle in the middle of the desert, or by the sheepish admission of the sound recordist whose soldering skills were not up to scratch and who hence became the butt of his supervisor's jokes. The sense of identity provided by such skills is also evident in the labels and descriptions interviewees attached to themselves and their work, when discussing their day-to-day practices. This is evidenced in the direct quotes found above, such as where the sound assistant refers to himself as a "pluggery and mending sort of bloke", and in the many accounts in which interviewees refer to themselves as 'techies' or invoke images of their work as being similar to Meccano. As shall be seen in Chapter 6, this self-proclaimed working identity was a point of distinction between themselves and non-technical above-the-line workers. Subsequently, these skills added value to their position in the production hierarchy. In addition to distinguishing themselves from their above-the-line colleagues, multiple interviewees stressed that these skills helped strengthen their identity as skilled workers and inculcate them into shared relationships with other craft-based production crew members. Often interviewees, particularly location recordists, would make revealing comments about the value they attached to such skills, stating that those in sound roles were the "first port of call for technical issues" or the "go-to man with techie stuff". Of course, the validity of such claims is questionable, as explored in Chapter 3, with all those enrolling onto TO courses sharing at least a few weeks of common training, and, moreover, it is doubtful that those pursuing non-sound roles would receive training lacking in its own technical specificities and rigour. However, what is clear from the evidence of these testimonies is that technical knowledge and the ability to apply this knowledge to the tools of their craft was fundamental to both the day-to-day practices and wider professional identity of those working in television sound.

This relationship between maintenance and professional identity is not limited to sound operators and has been cited in a growing number of studies on maintenance and repair. The link between maintenance skills and professional identity are particularly prevalent in environments that have clear hierarchies between manual and non-manual labour. In his ethnographic research on maintenance workers in university campus buildings, Christopher Henke (2000) detailed the self-prescribed identities that appear in the work of these professionals. Henke shows that, in response to their hierarchical relationship with scientists and researchers at the institution, maintenance workers constructed a "manly" identity around their work, contrasting this to the work of researchers which they perceived as both feminised and lacking in real world application. Furthermore, in their extensive review of the literature on such environments, Denis, Mongili, and Pontille (2015) cite numerous examples of hierarchical relationships in laboratory studies and show how the skills involved in maintenance processes acted to differentiate technicians from other forms of laboratory workers. Denis, Mongili, and Pontille showed that, in laboratories, technicians historically played a crucial yet subordinate role to both scientists and researchers. In this environment, the value of the scientist came from their ability to think and produce original ideas. The value of the technician came from their ability to work machinery, set up experiments, and repair subsequent damage. Clearly, for those engaged in maintenance and technical work, the knowledge and skills used in completing these tasks are a key component to the professional identity, and value, surrounding their work. This is particularly prominent in environments that have clear hierarchies and bring distinct forms of work into contact with one another, such as the laboratory, university, or, indeed, the television studio. Undoubtedly, identities constructed around maintenance and technical proficiency were apparent in the work of television sound operators, as evidenced by the numerous accounts listed above. Beyond comprising the essential knowledge on which they relied to work their own tools, these skills helped to establish their perceived position within the production hierarchy as being professionals of high technical ability. Furthermore, they enabled sound operators to distinguish their work from the work of above-the-line personnel and make sense of their professional identity in relation to their colleagues in the power hierarchy of production. As shall be seen in Chapter 6, the reduction in the need for

such skills has had a severe impact on this relationship and the resulting position of sound operators within the production hierarchy.

Throughout the 1980s and 1990s, shifts in the form of production technologies and the new affordances these technologies provided would result in the soldering iron being removed from the armoury of modern sound operators. Interviewees pointed to two technological factors that facilitated this decreased focus on equipment maintenance and repair. Firstly, the introduction and then industry-wide implementation of digital technologies in sound acquisition and editing, while, secondly, new components and manufacturing techniques made equipment smaller, more complex, and less hospitable to the would-be tinkerer.

Tinkering with Digital Tools

Digital technologies became widely implemented in television sound operations throughout the 1980s. For those working as sound recordists, this was normally in the form of Digital Audio Tape (DAT), a system developed and introduced by Sony in 1987. In post-production, as well as OB and studio sound mixing, the first introductions of digital equipment came in the form of digitally assignable and then fully digital mixing desks (see Chapter 7 for a detailed account of this). These technologies were fundamentally different from their predecessors and, as a result, had a significant affect on operators' ability to fix, maintain, and generally tinker with their machines. As argued by Manovich (2001) in his work on the "new media revolution", technologies of this kind are not governed by traditional mechanics or electronics but instead by the principles of numerical representation, modularity, variability, and transcoding (Manovich, 2001). This substantial change to the make up of technologies in recent decades has been raised directly in relation to repair and maintenance practices. Julian Orr (1996) argued that machines are interwoven into the human social world and that, subsequently, the work of technicians is to occupy one third of a triangular relationship between machines, users, and technicians. However, despite the social aspects of this work, Orr has

stated that there remains an underlying and unavoidable set of technical principles that shape machinery and, by extension, the practices of technicians':

> There is an irreducible core of the machine as a technical entity […] Technicians interaction with machines as technical objects colours, mandates, and sustains the interactions with customers, managers, and other technicians. Interactions happen, in some sense, and happen in the way they happen, because the machines need to have technical things done to them (Orr, 1996, 4).

Clearly, technicians' interactions with their machines are unavoidably shaped by the material construction and componentry of a given piece of equipment. A technician's ability to maintain and repair equipment is dependent on large stocks of experiential knowledge, built through individual interactions with machines and communally accrued information. Therefore, fundamental changes to the construction and principles of machinery, such as the kind seen in the shift from analogue to digital sound technologies, would require the significant adaptation and reestablishment of existing knowledge. With regard to such adaptation, Orr described how the convergence of electromechanical and computer technologies in Xerox copiers required technicians to adopt a hybrid identity that straddled the role of traditional mechanic and computer programmer.

The implications of the fundamental principles of technologies for maintenance and repair can also be seen in the work of Graham and Thrift (2007). Discussing what they call the politics of repair, they argued that technological commodities are now designed in a manner that makes them inaccessible to technicians and impossible to repair. Furthermore, in Western society, in which consumer electronics is a significant industry, commodities now intrinsically promote accelerated cycles of innovation, acquisition, and disposal, as Graham and Thrift stated:

> Many modern commodities are deliberately designed so that the possibilities of maintenance and repair are foreclosed. They lack any kind of transparency so that their functioning cannot be restored if they break down. This applies all the way from simple electrical plugs and power adapters, which are tightly sealed, to increasingly modular computer systems, through to motor car electronics (Graham and Thrift, 2007, 18).

As evidenced by the work of Orr (1996) and Graham & Thrift (2007), the underlying principles by which a technology functions clearly has significant implications for the technicians tasked with maintaining and repairing it. Developments in these methods and functions disrupt the knowledge and skills on which such maintenance and repair is based. For those working in television sound, this disruption undoubtedly came in the form of digital recording and editing tools. Unlike analogue sound technologies, in which sound waves are converted into electrical signals and then stored magnetically, digital audio tools use a system known as pulse code modulation (PCM) to quantize these electrical signals into binary data. PCM samples a sound wave at many times the frequency of the original sound, usually 48 kHz, and records a certain number of bits, known as the bit depth, per sample. What is stored, and subsequently copied, manipulated, and rerecorded is not the actual waveform but, instead, the data that represents it. The introduction of these digital computer-based technologies into sound operation represented a fundamental departure from the existing electro-mechanical tools traditionally used for recording and editing analogue sound. As such, the technical skills and knowledge accrued by sound operators over years of training and work simply no longer applied to the components and functions of these new technologies. Furthermore, as production and wider consumer electronics technologies converge, the tools of sound operation have become more reliable, more abundant, and significantly cheaper, acting to reduce the necessity of possessing the technical knowledge with which to fix and adapt equipment. In the era of vertical integration, sound recording and editing technologies were the tools of a small elite group of professionals, and were both extremely expensive and hard to source. This meant that sound operators had to know the precise workings of these machines, in order to be able

to maintain and repair any problems that may have arisen, as finding a replacement could significantly delay production. However, as production and consumer equipment has converged, these technologies are now readily available. As an extreme illustration of this, a number of interviewees stated that, in times of desperation, it is not uncommon now for mobile phones to be used as recording devices, although only for very specific types of content and, even then, as a last resort. While this is an extreme example, it nonetheless illustrates the shift in production equipment from elite production tools to readily available and relatively cheap pieces of technology.

In addition to the issues listed above, these technologies became widely implemented in the industry, at a time that coincided with the reorganisation of training, as discussed in Chapter 3. At this time, sound operator training was being shifted away from the technical and engineering led-approach of the broadcasters towards a varied and uncertain curriculum at universities that commonly lacked a technical underpinning. As evidenced by Orr (1996), tangible developments in the design of a technological change must be met with corresponding developments to the stocks of knowledge and skills applied to them. However, television sound operations, the training provided, and the subsequent stocks of knowledge accrued have clearly not kept pace with technological advancements. In fact, as shown in Chapter 3, training has fundamentally turned away from engagement with the technical aspects of the relevant equipment rather than developing in step with them. This shift in training has further entrenched the effects of new production technologies that are now fundamentally new in nature. These corresponding shifts acted to distance users from the technical understanding of their tools that was cited so prominently in the accounts of interviewees list above.

Clearly, the ability to fix or even technically engage with sound technologies would require a significantly different set of skills than before as they entered the digital domain. This is often cited by interviewees as a contributing factor to the shift away from technical knowledge, namely that, as digital technologies became common place, their need and ability to interact with their machines beyond strictly their operational remit was almost completely

removed. The comments of one location sound recordist illustrate the disconnect between his existing practices and experience and the affordances of new digital technologies:

> DAT for example, you couldn't get inside it, you just couldn't. There wasn't a screw driver slot, you probably had half a dozen tiny screws that could take one panel off but you couldn't get inside anything else. There were no user friendly parts you could get to with a DAT machine, there was nothing we were taught or told to maintain...No, with a digital solid state machine you just waited for another one to be sent out, very few user friendly parts. You couldn't even clean the heads on a DAT machine, you got a DAT cleaning tape but you couldn't actually clean them (Sound Recordist 1).

Another location sound recordist stated:

> You know, it's now just have one microphone and adjust your levels and things but not repairing bits of wire. A lot of things you cannot repair yourself, condenser mics and digital recorders, if they go wrong, well, they've gone wrong. Plugs and that sort of thing is fairly simple but to be able to get in [a digital recorder] and get solder on it and get it working again is another matter (Sound Recordist 7).

An OB sound supervisor also discussed this issue, specifically touching on the impact of circuit boards and the extreme reduction of individual component size and raising the issue of a disconnect between the practices established in his early career and the affordances of these new technologies:

> The days when you could actually get in with the soldering iron and mend things are long gone. The microscopic detail on a printed circuit board is pretty mind boggling to say the least, the chances of actually mending a piece of equipment on the job is now pretty slim. Towards the end at the BBC, even the studio engineers would be returning bits of equipment to the manufacturer for attention rather than always doing it themselves. Now you get multilayered printed circuit boards, you might be able to follow it through from a circuit diagram, but it's likely to be pretty complex and not a quick thing to diagnose (OB Sound Supervisor 4).

Another OB sound supervisor also touched on this:

> I used to delve into the old sound desks and pull things out. It was quite easy to work out what had gone bang. Now it's all down to digital totally, the audio path is digital, the routing is now done in the digital domain. If it goes wrong, you're pretty well stuffed actually. It's so computerised all you can do is close it all down and reboot it all and let it start up from scratch, like your computer at home (OB Sound Supervisor 3).

Another documentary Sound Recordist stated:

> You needed that knowledge because equipment was unreliable, but then we got integrated circuits and Japanese circuit board technology, and you just don't really need that kind of knowledge anymore (Sound Recordist 5).

The reduction in component size was also mentioned as a significant shift by one manufacturer interviewed. Douglas Macintosh, founder of SQN, the Isle of Man-based company which achieved widespread success with their range of front-end portable mixers, stated that, by the late 1990s, the manufacturing process of their mixers shifted from construction and soldering by hand to automated circuit building, primarily due to the component size being reduced until they were unworkable by human hand:

> In the end, the components got so tiny that they were beyond our girls at the workshop soldering up joins on a board and they had to be done by flow soldering. They came to see us and said 'Well, if you install all this stuff for flow soldering you can make all the boards you need for a year in a week' (Douglas Macintosh, Founder of SQN Mixers).

SQN was, and is, a relatively small manufacturer. At its height, it employed approximately 10 people at its factory in Balthane reaching average annual revenues of around £1 million. In contrast, Burnley based AMS-Neve employs 70 people with a turnover of almost £10 million, while German giant Sennheiser employs more than 2500 people and had a turnover of €682 million in 2015 (Bounds, 2015; Sennheiser, 2017). Undoubtedly, these larger, more powerful manufacturers would have changed their manufacturing processes long before SQN, a family- owned company based on the Isle of Man, was feasibly able to, following the developments seen in microelectronics in the 1970s (Ensmenger, 2012; Briggs, 1995). What is clear from the evidence provided by the end users of these technologies and this one manufacturer, SQN, is that the technologies of television sound have changed dramatically. Technologies that would have been electronically and mechanically-based in previous eras are now almost completely 'black box' technologies and, therefore, alien to those skilled in traditional electronics or other individuals hoping to fix or tinker with their professional tools. As circuits became more complex and components smaller, the hobbyist, a practically minded operator with some BBC training in electronics, no longer possessed the skills

or knowledge required to work with these machines as they had previously with electro-mechanical analogue sound equipment. As many interviewees stressed and as argued by Gillespie (2003), those with the ability to maintain, fix and adapt machines now work for manufacturers rather than broadcasters.

These testimonies could be interpreted as a nostalgic look back from sound operators aiming to protect themselves from the "backdoor workforces" (Caldwell, 2010) of current and future sound operators, who they view as less skilful than themselves. However, this inference would go against feelings subsequently expressed about the continuing role of sound operators, with numerous interviewees stressing that, despite this lack of technical knowledge, those who entered the industry after the era in which technical knowledge was a necessity are still skilled and impressive sound recordists. One sound recordist, who was trained by the BBC and started his career in the analogue era, stated:

> Digital equipment was completely unfixable, but it was also pretty reliable. The job has certainly changed, the craft has gone, but that doesn't mean to say there aren't some really talented guys out there (Sound Recordist 8).

A former sound supervisor also touched on this point, stating:

> I think the actual techniques are still pretty much the same. The technologies have changed but how you actually do the work is still very similar, it's still very skilled (OB Sound Supervisor 8).

A dubbing mixer furthered this argument, stating that, while new industry entrants do lack some of the technical skills possessed by their predecessors, these skills are no longer necessary to be a successful dubbing mixer:

> I have been known to get the soldering iron out. I do solder and I know how to and perhaps this generation now don't have the technical under-pinning, but they just don't need to have it, they don't need to get their soldering iron out as there is precious little to solder in a dubbing theatre these days (Dubbing Mixer 6).

Outside of the research conducted for this thesis, Lyndon Bird, another former BBC sound recordist known for his work with David Attenborough, stated in an interview for Wild Film History that:

> Certainly, we probably had skills which they probably wouldn't recognise now. I remember heating up a screwdriver as a makeshift soldering iron. They used to say to me, shall I temper the screwdriver or you? That's the kind of skills which are probably missing a bit now, don't need to. We had to look after our own equipment much more than needed nowadays... I think it's just as skillful...The physics are still the same I think, yes (Bird, 2006).

While Hugh Robjohns, writing for *Line Up*, has also made the above point, stating that, despite a lack of engineering knowledge, people can still be skilled operators:

> Recently, I was introduced to someone who was described to me as a 'sound engineer.' However, the discussion that followed revealed that the person concerned actually had very little appreciation of audio engineer-ing, yet was undoubtedly a highly skilled and talented 'sound operator.' (Robjohns, 2010a, 1).

Clearly, the skills held by sound operators have changed as technologies developed and the affordances inherent within them shifted. Operators now concede that the technical knowledge once fundamental to their daily practices and working identities no longer features prominently in the day-to-day activities of sound operators nor holds such prestige, as digital technologies have replaced traditional analogue tools. As has been shown, these skills were once fundamental to professional identity, as illustrated by the interviewees' self-identifications as "pluggery men", "techies", and "the go-to man for technical stuff". Multiple interviewees likened their work to Meccano and described how maintaining sophisticated arrays of unreliable technologies was the foremost concern for sound operators' work. Clearly, this identity no longer fits with the wider context in which sound operators work. Digital tools are alien to operators trained in traditional basic electronics, and interviewees consistently illustrated the disparity that existed between the practices and assumptions developed in the analogue sound era and the affordances and construction of digital technologies. As a result of the increased miniaturisation and complexity of their components, these new tools are now increasingly hostile to would-be tinkerers and are almost completely irreparable. Furthermore, sound operators no longer receive training founded on technical skills and engineering knowledge. Training has moved on from practices resolutely established and fully interwoven into the industry, and is now conducted at universities which, as previously discussed, have faced continuing struggles in establishing the training they wish to provide. In this volatile and shifting environment, technical skills and knowledge have slipped from the focus of both training and working practices. Resultantly, operators are no longer able to interact with the tools of their profession in the same way as in the analogue era and, significantly, do not place the same value and importance on these skills.

The changes described above are not unprecedented, with deskilling a common theme in television and production studies literature on the introduction of digital production technologies and the working arrangements they facilitate. Furthermore, Chapter 4 showed how these same coinciding forces have disrupted the operator's role in the innovation process and stripped 'tinkerers' of their once important role in the development of technologies. Clearly, not only have these industrial and technological forces influenced practice beyond innovation,

but they have also significantly changed this once fundamental aspect of professional practice. However, to simply refer to this process as a deskilling of the type that features heavily in production studies literature would be short sighted. Sound operators, both those interviewed for this research and those whose testimonies are represented in the wider trade press, still view their work as highly skilled and requiring specific knowledge or even ‘talent’. The operation of these professional tools still holds considerable value in this new technological era, despite the unquestionable redundancy of such skills, which were once held in high regard. As will be discussed in Chapter 7, that which has taken place in television sound could more accurately be described as a redistribution of skill. As shall be discussed below, while sound operators are now looking to re-identify their work and shift focus away from technical knowledge and towards creativity and artistry, this has not been achieved without consequence. The following chapter aims to show that sound operators have experienced significant consequences in terms of their status in the wider production hierarchy, as new technologies and working arrangements threaten existing production norms.

Hierarchies

The two previous chapters of this study have shown that, over the past three decades, sound operators in British television have experienced fundamental changes to their role in the innovation process for the design of new equipment, as well as in terms of how they interact with these technologies as part of their daily working practices. In light of factors such as industrial reengineering, the restructuring of training, and the integration of digital production technologies, these aspects of the working life of television sound operators have undergone rapid and far-reaching change. This section of this research aims to explore how these wider industrial factors impact on both the sound operator's working relationships and place within the hierarchy of television production, which is inherently an exercise in collaboration between a number of professionals with a wide range of highly developed skills and practices. However, not all professionals working in this environment command equal status, and their objectives and practices are often in conflict with their colleagues from different departments. As such, the way in which individuals navigate the hierarchies in the production environment is an important aspect of professional practice. This chapter will argue that, as with innovation and user tinkering, wider industrial, technological, and organisation trends have changed the way sound operators work within these hierarchies and, ultimately, have resulted in their perceived position within them being marginalised over time.

Television sound has been the focus of much analysis in both academic and trade journals in recent months and years, as a spate of 'bad sound' incidents have been gaining considerable attention from television viewers. The focus of this scrutiny centers on the issue of unintelligible dialogue and was quickly dubbed "mumble-gate" by those in the industry. One of the most well-documented incidents involved the BBC drama *Jamaica Inn* (2014), which attracted 2,200 complaints due to inaudible dialogue and lost over two million viewers from its premiere time-slot (BBC News, 2014). More recently, BBC dramas *Happy Valley* and *SS-GB* came under similarly heavy criticism for their own intelligibility problems (Hilton 2014; Brown 2016). Analysis has revealed numerous explanations for this phenomenon, including cuts to training, the shortcomings of in-built speakers in flatscreen television sets, and the undervaluing of sound in television production (Hillman & Pauletto 2016; Brown 2016; Armstrong 2016; Geraghty 2016). However, little research has been conducted on the day-to-

day professional practice of sound operators, specifically in the context of British television, and even less on the historical contexts from which these practices emerged. While there can be no definitive explanation for this recent problematic trend, it does provide a useful opportunity to examine television hierarchies and their effects on individual craftspeople. Close examination of professional practice and its historical context reveals significant insight into the conditions under which television soundtracks are created and allows for better scrutiny of our understanding of sound in television research.

This chapter argues that the position of sound professionals within the production hierarchy has, over time, been steadily eroded. In addition, their professional identities as respected craftspeople has been threatened due a number of contributing factors, including technological advances, the reengineering of television industry employment, and the increased focus on cost during production. Due to these combined factors, the resources designated for sound are increasingly targeted as a cost-saving opportunity by above-the-line personnel, who, in many cases, no longer recognise the need for dedicated sound operators. This undoubtedly has a significant impact on both the way sound operators work within the production hierarchy and the outcome of their work, as illustrated by 'mumble-gate'. The hierarchies and working environment of sound engineers in pervious eras, such as that which saw the integration of sound into film (Lastra 2000; Altman 1992; Batcho 2012), have been highly scrutinized, but few studies have explored the implications of these factors on sound operators working in television.

In an effort to bring light to these issues, this chapter first explores the working environments of vertically integrated public service broadcasters in the period between the expansion of the 1960s and the industry-wide restructuring that occurred throughout the 1990s. It will then explore the technological developments that occurred throughout this period and beyond and which have been signposted as significant in their disruption to existing working practices. The exploration of technological development in this chapter shall be limited to production sound technologies. As Chapter 7 will provide a detailed exploration of the development of post-production sound technologies (see pages 175-189), these shall not be listed

here. This chapter broadly focuses on a range of operational roles in television sound and, as such, the accounts of those working in post-production and their experiences of changing production hierarchies will be fully integrated into the wider argument. Finally, an exploration of how economic, policy, and industrial factors have affected the area of employment, and again, disrupted working practice for sound professionals will contextualise these technological developments.

This section of this thesis aims to expand on the work of the previous two chapters in order to focus on the working life of sound professionals in British television, directly in relation to production hierarchies and the relationships between sound operators and wider production personnel.

As discussed in Chapter 1, the impact of production hierarchies on the work of sound operators in film has been well documented. James Lastra (2000) explored how sound operators in early cinema had to drastically redefine their work, adopting a model of intelligibility in order to conform with the existing hierarchy and be accepted into the established film industry. Rick Altman (1992) has argued that production companies partly dictated the form taken by sound in film through their strategic hiring of radio technicians, a professional group which had already developed its own representational model. Furthermore, James D Batcho (2012) has built on Lastra's analysis, stating that, through a combination of technologies, aesthetic codes, and industrial frameworks, the power to dictate the form of sound, both aesthetically and technically, was consolidated by those occupying the highest ranks in production companies:

> Those with the power in Hollywood were now able to dictate methodology to the sound technicians...studio executives, not sound artists or film directors, helped to build the template for an aesthetic approach to sound that remains standard practice today (Batcho 2012: 1105).

The impact of production hierarchies on working practices is not only limited to the earliest period of sound cinema. In his work on Dolby Surround, Jay Beck (2008) questioned the legitimacy of the term 'sound designer', arguing that, while it is most readily attached to individuals working directly in sound acquisition or post-production, it can also find use when applied to those higher up in the production hierarchy whose decisions will inevitably influence sound:

> The true designers of sound are either those who are able to dictate what technology will be used or those who adapt the existing technology to suit their particular aesthetic needs...In the case of such individuals, the choice of technology generally preceded any serious thought about its aesthetic application (Beck 2008: 75).

In her work on mumble-core film, Nessa Johnston (2014) tackled the issue of how wider contextual factors have impacted on production practice, with implications for the sound track. Johnston discussed these issues in the context of mumble-core film, a genre that often uses self-shooting and very basic production technologies. Mumble-core soundtracks were often dismissed as 'bad' due to the mumbled nature of the dialogue, the prominence of noise, and their resistance to 'creative' sound design. However, Johnston shows that the soundtracks of the genre were, in fact, the result of a set of stylistic decisions taken by mumble-core filmmakers, and their ensuing practice, who value the truth and sincerity of a performance over a mainstream film aesthetic. Unlike Johnston, this thesis does not argue that recent instances of unintelligibility in British television have been, in any way, deliberate styl-

istic choices made by those at the top of the production hierarchy. Intelligibility remains the standard representational model strived for by all working in television. However, what is clear, as evidenced by Lastra (2000), Altman (1992), Beck (2008), Batcho (2012), and Johnston (2014), is that decisions made by those who wield power within these hierarchies shape the methodologies applied to the practice of film and television sound production. The producers interviewed for this research are not pursuing a new stylistic approach to television sound, and, in fact, many even stressed the importance of sound despite contradicting this in practice. They are, however, responsible for establishing the working and technological environment in which sound acquisition, editing, and mixing takes place, as well as overseeing these processes. In the new television production economy, producers now wield ultimate creative and technical control.

Hierarchies in the Era of Vertically Integrated Broadcasters

As has been discussed earlier in this thesis, from the launch of ITV in 1955 until the reforms of the 1980s and 90s, British television production remained in a protected state of "comfortable duopoly" (Born 2004; Johnston and Turnock, 2007). Due to the differing funding mechanisms for the BBC and ITV, both institutions lacked a genuine market competitor. Both the BBC and the ITV franchises operated as large vertically integrated organisations with large pools of permanently employed production staff. For both the BBC and ITV, financial restraints were rarely felt by those in above-the-line production roles, with interviewees often confirming that such considerations almost never impacted on their own practices. This lack of direct financial competition and the consistently healthy income streams at both companies provided a "benevolent environment" (Born 2004: 37) for those working within them, in which the pursuit of 'quality' public service broadcasting was the dominant motivating factor (Brunsdon 1997: 143; Tunstall 1993).

For those staff working in technical roles, job security was an inherent characteristic of employment at both organisations. Entry into technical grades, most commonly as TOs, was

undoubtedly competitive but, once achieved, was viewed as a lifelong career with progression inevitable, albeit slow. While Chapter 3 has already laid out in detail the form and curriculum of the training provided to those entering technical roles in vertically integrated broadcasters, it is important to briefly address this training in relation to the development of production hierarchies and the shared knowledge and experience that this training environment cultivated. The vast majority of entrants onto TO courses were working class men educated to A-Level standard, with A-Level maths and physics a specified requirement (Woolf 2006: 26). Training provided by the BBC, such as the TO and TA courses, aimed to cultivate a significant level of understanding across a broad range of technical roles and, as a result, all aspiring TOs would complete a generic introductory training before going on to specialise in their respective roles. This training environment, along with the camaraderie that vertically integrated organisations provided and the largely shared socio-economic background of employees, helped to foster a relationship of cooperation and teamwork among TOs, thus influencing the future working relationships of production crews. As one sound recordist who joined the BBC film department in the late 1960s said:

> It was like one big happy family [...] I tended to move around between different cameramen but the relationship was very good. Most cameramen knew and appreciated sound […] there was an awareness [...] it didn't always work but, yes, you had a good working relationship *(Sound Recordist 1).*

Another interviewee compared the tightly knit relationship shared by immediate colleagues working on a production to that of a military unit.

> [Going on location] Was like going out as a mini platoon, with the cameraman as the leader...The cameraman was the operator in charge, he was on a higher grade than the sound man, but we were definitely a team, there was a real team spirit (Sound Recordist 4).

Yet another interviewee touched on this, commenting on the "common purpose" and "common way of doing things" instilled into operators working at one particular broadcaster:

> Everybody had a common purpose, everybody went through the same training stuff at Evesham [...] There were clashes obviously, there always is in those environments, but everyone was using the same sort of rules (Studio and OB Sound Supervisor 2).

During the filming the Adapt Project's 1970s OB simulation, the contributing sound supervisor joked during a full-crew summary discussion about the OB culture :

> When working on OBs, when you woke up in the morning, you were more likely to see your senior cameraman than your wife (Adapt Simulation OB Sound Supervisor).

Communal meals and staff canteens provided further opportunities for collaboration and integration among technical staff. One sound recordist emphasised the camaraderie experienced among the wider pool of permanent production staff at the BBC:

> The BBC had a canteen and usually all the sound recordists and cameramen sat on one table and you'd have discussions and share ideas (Sound Recordist 7).

Furthermore, tangible evidence of this close working relationship, and the understanding of one another's role within it, is present in the data from Adapt's 16mm film simulation. During this exercise, participants were tasked with setting up and filming a 16mm documentary sequence centred around a seated interview. Within just 24 minutes of accessing the set, the participating crew had re-familiarised themselves with and set up the 1960s equipment, and were ready to shoot. During this set up period, numerous processes were worked through communally, with operators and the director contributing collaboratively to technical elements, such as lighting set-up and microphone placement. The boundaries between the distinct roles involved in the simulation were clearly apparent to observers and were bought to the fore by participants when the cameraman made an unsanctioned adjustment to a lighting fixture. However, what was clear from the interactions and discussions of participants and evidenced by the pace at which they negotiated the task was their understanding and appreciation of each other's practices and processes. A particularly clear example of this came when, to the obvious embarrassment of the sound operator, the camera assistant diagnosed and remedied an issue with a Nagra tape recorder.

It was not only the relationships between those working in technical positions that benefitted from the environment fostered at the BBC and the ITV franchises. Interviewees often cited that their professional relationships with producers and directors were considerably better when working at vertically integrated broadcasters. With above-the-line staff recruited disproportionately out of Oxford and Cambridge Universities (Tunstall 1993; Ursell 2000a), there was undoubtedly a noticeable class divide between them and the technical staff who worked under them. Interviewees who had worked in technical grades often actively pointed out this divide, describing such above-the-line staff as 'creative types' or 'artsy types', differentiating their production role from that of the 'techies'. However, while the existence of this divide was apparent to all working on production, relationships remained positive. Within vertically integrated broadcasters, the balance of power, or at least the perception of which, was not viewed as completely lying in the hands of those working in above-the-line roles. Sound operators in both production and post-production roles often noted their ability to con-

tribute impactfully (such as cutting, doing another take or even changing location) to a shoot based on the sound requirements, as one sound recordist stated:

> You were expected to [raise concerns with the director] and they were considered a fool if they ignored you (Sound Recordist 5).

A sound supervisor, based at Pebble Mill Studios until redundancy in the late 1990s, added:

> Our job has always been to technically realise the creative idea...Until 1993, people like me, technical people, could actually stop a programme being broadcast because it wasn't technically good enough. We were always the controlling factor in their, well, sometimes, lunacy (Sound Supervisor 8).

A dubbing mixer, who joined the BBC in the mid-1970s, strengthened this argument:

> There was a time, back when I first joined the BBC, when the dubbing mixer could say 'this is technically unacceptable for transmission, this is not transmittable' and they would have the power to pull it on a technical basis (Dubbing Mixer 2).

An OB sound supervisor spoke of how the management structure of the BBC helped sound recordists/supervisors to wield influence and have an impact on above-the-line staff decisions:

> We had a head of sound, an assistant head of sound and four sound managers, and a sound organiser as a management structure, all of who has significant status with other departments. If you went to them with trouble regarding a director, the sound manager could have a word with the director's line manager. There was a chain [of command] so you could make your professional opinion known through another route (OB Sound Supervis*or 4)*.

Not only did vertically integrated producer-broadcasters provide a protective, creativity-nurturing, and cohesive environment in which to work, they also provided sound operaters with technologies that increased their autonomy and helped to project their image as skilled craftspeople. For location recording, the use of separate quarter-inch tape recorders in conjunction with 16mm film cameras, known as "double-system recording", had become the norm on most location shoots by the 1960s. These systems used a cable sync system in which a motor mounted on the camera provided synchronisation, in the form of a 50 Hz pulse, to the sound recordists' tape recorder (Chapman 1960: 10). With the development of crystal sync in the late 1960s, the technique of using a highly accurate oscillating crystal to produce a constant pulse for synchronising sound with images, it was no longer necessary for sound recordists to be tethered to camera operators via the sync lead method of double system recording. This physical decoupling from the camera was a crucial development in establishing sound recordists' working practices during this period. The notion of freedom was a theme that came up in multiple interviews in relation to crystal sync. Free movement and independence from the camera operator gave sound recordists the ability to focus on their role and strengthened their professional identity as skilled autonomous craftspeople in their own right. As one interviewee described, crystal sync:

> …was freedom. It was really great, especially on factual, … productions where you'd be dashing around and stuff. It allowed you to focus on getting the best sound (Sound Recordist 6).

Another interview declared that:

> We were free! It was it was unbelievable, it was great. You weren't being dragged hither and thither by a cameraman ever (Sound Recordist 4).

As discussed in Chapter 2, 1/4 tape recorders became increasingly sophisticated and reliable during the 1960s, becoming the standard tool for sound acquisition in almost all location filming. By the end of the 1960s, the Nagra 4 had become the dominant 1/4 machine, and would remain the industry leader until the 1980s (Nagra 2016). Though these machines had a reputation for impeccable reliability and performance they required skilled maintenance and operation in order to perform at this high standard. As shown in Chapter 5, sound recordists would rarely leave for a location without a tool kit, including a soldering iron and solder, with which they could repair any damage sustained by their machines.

This was not the only issue that required skilled operation and knowledge for sound operators to effectively complete their work. As laid out in detail in Chapter 2, the microphones of this era were incredibly labour intensive, requiring both skill and experience to manage. Due to their unreliability and operational complications, radio microphones were, as cited by numerous interviewees, only used as a last resort. This meant that a combination of boom mics and creatively concealed effects mics was the standard approach for obtaining sound on location. Thorough knowledge of their equipment and its skilful and creative use were crucial to sound operators performing their role to the high standard expected. This

combination of skills furthered the sound recordist's position as an important and respected member of the production team.

Sound operators working in post-production positions also benefitted from technologies that increased autonomy and promoted their image as highly skilled craftspeople, the details of which have been laid out in Chapter 2. In summary, post-production sound processes relied on a team of highly skilled operators, the individual practices of whom were fully interwoven into the practices of the others, creating a team of operators with a good working relationship essential to completing a programme mix. Soundtracks were constructed by manually cutting and splicing magnetic film stock, which was not only a skilful practice but one that took considerable time and effort. This made re-editing extremely undesirable for those in above-the-line roles. During the mixing phase, the lack of fader automation made dubbing an extremely stressful process, as all fader mixing had to be undertaken 'as live'. This meant that, no matter what, a dubbing mixer had to achieve a successful take. Adding to this considerable stress, the track counts available to dubbing mixers were extremely limited, with few satisfactory methods available to extending them.

Clearly, post-production sound in this era required an entire team of highly skilled workers with a thorough understanding of their technologies and practices. Under such conditions, it was simply unfeasible for anyone other than a dedicated team to undertake the dubbing process. However, in the years and decades that followed, technological advances and unprecedented changes to the British television employment landscape would disrupt the established practices and production hierarchies that had been stable for a number of decades.

Technological change in Production Sound

> You can imagine our horror when video came in and they wanted us to connect to the camera again. The last thing you wanted was to be like a puppet attached to the back of a camera ready to pounce and run for everything! (Sound Recordist 7).

This comment from the above Bristol-based sound recordist is representative of the wider response to videotape and its effect on working practices in the television sound community. Multiple interviewees have pointed to the introduction of videotape to location shooting as a major disruption to the existing working practices of sound recordists. John Caldwell (2008) examined how the transition from the use of Sony Betacam to DVCam, HDCAM and other more modern picture formats in US television disrupted crew sizing and working arrangements. Caldwell pointed to CNN as a prominent example of crew reduction procedures and multiskilling due to technological and corporate pressure, but falls short of examining how these changes affected those working in sound. This research focuses on the working practices of sound operators and, as such, does not presume to offer a detailed history of video in British television (for this see Ellis 2012). Briefly, however, U-matic tape and subsequently Sony Betacam began to find uses in the 1980s, particularly in news gathering, due to its improved light sensitivity, speed, low cost, and ability to record for extended periods of time with sound automatically synced to pictures. These advantages, in combination with advances in videotape editing and camera technology, soon led to videotape being deployed in place of 16mm film, despite considerable animosity from production crews. The bringing together of sound and picture into one medium, reducing equipment and workload, as well as more manageable camera-recorders meant that camera assistants and sound assistants were no longer required. It became standard that, when working with video, a crew of two would be tasked with doing the job of a five-person film crew. For sound recordists in particular, this was seen as a regression, as videotape brought the sound operator, once again, under the direct instruction of the camera operator, due to the combined picture and sound recorder (see Fig. 17). The absence of assistants also meant increased workloads and blurred boundaries for those work-

ing as sound recordists, with one sound recordist commenting:

> VT to a lot of us was a retrograde step because you were tethered to the camera and you couldn't be quite as creative as you could be separately...it restricted you as a sound recordist...Also, going out on a video shoot, effectively the sound recordist was doubling up as a camera assistant. You were expected to carry the tapes, keep an eye on him, make sure he didn't fall over, and there was a little bit of resentment or ill feeling that you were now becoming the camera assistant. You felt you had enough to worry about and think about recording sound (Sound Recordist 1).

Another sound recordist noted the altered, and often strained, relations between sound and camera crew in this new working pattern:

> I used to get really angry, I'd say 'don't just get up and go running off, how am I supposed to work a boom and do my mixing and carry all these batteries?' Often, you'd just rip the umbilical out the back of the camera and that was the end of filming (Sound Recordist 3).

It is clear from such statements that working practices when using video were vastly different than working with film. For sound recordists, it was restrictive not only due to being physically reattached to the camera, and therefore less able to manoeuvre in the hunt for the best sound, but also in terms of reduced autonomy in the hierarchy of these slimmed-down production crews.

Fig. 17: Sony's BVW-35 was often cited by interviewees as an early example of the recorders used for shooting on videotape. The above image clearly shows the bulky nature of the combined image/sound recorder. (Image: Marcel's TV Museum, 2017)

Video was not the only technological advance that would be used in ways that altered the working practices of sound recordists and their production colleagues, with radio microphone technology also seeing significant developments throughout the 1980s and 90s. Since 1972, British company Audio Engineering Ltd had dominated the television market with its Micron 101 systems, which replaced the existing BBC TM3/RC4 systems (see Fig. 18). However, with an increasing amount of single camera tape-based shooting occurring in ENG, documentary, and current affairs, radio mic systems became an investment target for large industry players, such as Sony and Sennheiser. By the early 1980s, diversity receivers[6], such as the 1981 Sony PWS and WRR series, started to feature more commonly among industry-standard radio receivers of the time (see Fig. 19).

[6] Diversity microphone receivers are receivers systems that have two antennae and two receiver channels. The system automatically switches between the two selecting the channel receiving the strongest signal therefore improving the reliability and audio quality. (Audio-Technica, 2016b)

Fig. 18: BBC RC4 Receiver. (Image: Jon Wayre)

Diversity systems all but eliminate signal dropout at reception through the use of two receivers for each signal and can, therefore, continuously switch between receivers depending on which had the strongest signal, avoiding any dropouts in either of the individual receivers (Hillmann, Biddlecombe, Rodda, & White 1998: 55; Bush 1981: 60; Hillmann 1998: 26). In addition to the widespread adoption of diversity systems, manufacturers started offering systems that used UHF frequency bands instead of the VHF frequencies used by the earlier systems. UHF signals are less susceptible to the interference from other electrical devices and equipment that can occur when shooting. However, the shorter wave length of UHF transmis-

sions means that they are more at risk of multipath drop outs[7] at reception; however, this can be avoided through the use of diversity receivers. UHF systems also have the added advantage that the aerials required were smaller and more manageable than those used by VHF systems (MacRae & Weston 1994: 9). Despite being more costly, by the mid-1990s, UHF systems had become the standard rather than the exception (Kemp 1995: 48).

Fig. 19: Sony WRR UHF diversity radio mic receivers. (Image: Tim Heath)

The development of these systems had a two-fold effect on professional practice. Firstly, they aided the developing trend of self-shooting and one-operator crews in many forms of television, such as documentary and current affairs. The ease of use and reliability of UHF diversity radio mics meant that it was possible for a camera operator or self-shooting director, armed with a lightweight video camcorder and one or two radio mics, to absorb the role of the sound recordist into their own role. This task simply no longer required a dedicated skilled

[7] Multipath occurs when RF signals arrive at a location via different transmission paths (usually referring to a combination of direct and reflected signals). Under these conditions, the audio output of the wireless receiver may become noisy, or the audio may be lost entirely for a short time. Multi-path is most likely to occur in closed areas where many metal objects are present, but can occasionally be troublesome in most situations. (Audio-Technica, 2016a)

operative wrestling with complex equipment in order to achieve adequate results. One producer touched on the introduction of video during her interview:

> Video had a big impact. Once you had video cameras you had sound, it all feeds into the camera. You don't need a sound recordist anymore because the cameraman is recording the sound and camera people started learning how to mic up. If you really did need a boom or something, well, an AP can just shove a boom up somewhere (Freelance Producer 1).

In drama, the advances in performance and reliability has arguably spurred what many interviewees have described as an "over dependence" on radio mics. While the unreliable radio mics systems of the past were used sparingly, their use has become increasingly common in modern production, as technical improvements have made it possible to reliably capture audio from a previously unworkable number of radio mics, often as many as 8-12 at any one time. The flexibility of these systems made them popular with directors, as it allowed for multi-camera shooting without the added concern of accommodating a boom and the shadows that it casts. However, there is considerable debate among the interviewees pariticpating in this research about whether the quality of sound capture by radio mics can match that of a skilfully used boom. The successful use of a boom mic involves significantly more than simply holding the pole in place, with interviewees often describing how the flexibility of a moving boom mic allowed them to capture perspective in order to better match the sound to the shot, and record more consistent levels. While all of these elements are eradicated with radio mics, the practical advantages of their use often result in the skilled task of boom operating going unused. Not only does this relieve those working in sound of the skillful task of boom operation, but it also brings with it the added concerns of hiding radio mics in costumes while trying to work alongside departments with conflicting goals and requirements. One interviewee, who works as a dialogue editor for numerous mid-range dramas such as *Class* (2016) and *Becoming Human* (2011), touched on this subject, stating that, due to multi-cam-

era shooting:

> No boom can get anywhere near [the actors without being in shot] which means it's all radio mics and, of course, costume and makeup is now a huge department. So, even the tiny radio mic has to be stuffed out the way. If a recordist puts a mic on in the wrong place, costume complains and, more often than not, directors, who are normally visual people, will say it [the sound] can be fixed in post (Dialogue Editor 1).

Undoubtedly then, the technological landscape in which sound operators work has disrupted their professional practice. Technologies, and the new ways of working that they promote, have, in many instances, seen sound recordists stripped of many of the skilled tasks upon which they used to be relied. Sound recordists have also seen their relationship with other members of the crew adapt, due to the form and affordances of production technologies, which removed much of their autonomy and brought about new conflicts to be negotiated and resolved with production colleagues. However, to conclude that sound has been marginalised in the production hierarchy simply through new ways of using technology would be to omit many important contributing factors occurring in the wider television industry, due to policy change, increased competition, deregulation and the rise of independent production.

Industrial shifts in UK Television

Earlier chapters have already touched on Castells' (1996) work on the network society and how this new organisational model has affected broadcasting and, by extension, a number of aspects of the work of television sound operators. However, the effects of this shift towards the network society are undoubtedly felt most forcibly in the way labour is organised and the forms in which people gain employment. The rate of self-employed workers and those in other forms of flexible employment has risen as major economies have reengineered themselves away from agriculture and manufacturing, a process characterised by vertical integration and full-time employment, and towards services as the dominant economic sector. On this, Castells has stated:

> As networking and flexibility become characteristic of new industrial organisations, and as new technologies make it possible for small business to find market niches, we witness a resurgence of self-employment and mixed employment status. Thus, the occupational profile of the informational societies, as they emerge historically, will be far more diverse (Castells, 1996, 221).

In addition to Castells' work, Richard Sennett argued, in his 1998 book *The Corrosion of Character*, that "new capitalism" has fundamentally changed the role and wider life of the workforce in western society. In this environment, companies and organisations have moved away from "military-style bureaucracies" (Sennett 1998: 84) to become ever-shifting "flexible networks". As a result, the traditional 'career', comprising service to one organization, with progression based upon time served and skills acquired, has been abandoned and replaced by insecure work in which risk is an inherent part of working life. Career progression now takes form as a continual process of "ambiguously lateral moves" (Sennett 85: 1998), as workers try and negotiate these networks alone without the clear career ladder that vertically integrated bureaucracies provide. Sennett argued that, due to consistent and unyielding changes to policy, economic strategy, and technology, uncertainty is now "woven into the

everyday practices of vigorous capitalism. Instability is meant to be normal" (Sennett 1998: 31). Although Sennett's work focused almost exclusively on the US economy, the parallels between his findings and the experiences of working in the British television industry are clear.

As detailed in Chapter 1, the 1980s and 90s saw profound changes to the landscape of British television, which were underpinned by the neo-liberal economic policies championed by the Conservative government of the time. The launch of Channel 4 in 1982 ushered in a new business model, the publisher-broadcaster, spurring the growth in the independent sector. Subsequently, the Broadcasting Act of 1990 mandated that the BBC and ITV had to source at least 25% of all output from the growing sector of independent producers (Ursell 2000b: 752). The duopoly that had dominated television thus far was broken when Channel 4 took responsibility for its own advertising revenue (Born 2004: 51). Furthermore, satellite television also saw significant growth during this period, providing further competition to existing broadcasters (Ellis 2002: 62; Tunstall 1993: 11).

In the midst of these significant organisational changes, below-the-line production personnel saw their employment status and working environment significantly change. As vertically integrated broadcasters attempted to adapt to a publisher-broadcaster model, they radically reduced their workforce and shifted towards the use of informal networks of casualised freelance workers (Starkey, Barnatt, & Tempest 2000; Storey, Salaman, & Platman 2005: 1040). The implications of these wider industrial shifts for below-the-line workers were wide-ranging and extensive, as evidenced by redundancies at the BBC and ITV. From 1986 to 1996, the BBC made 33% of its staff redundant, whilst this figure was 44% at ITV for the same period. At both organisations, 80% of these redundancies comprised below-the-line production staff (Ursell 2000b: 757)

Storey, Salaman, and Platman (2005) demonstrated how the reputational nature of informal networks can lead to considerable anxiety among production staff. This is due to the insecurities inherent in the ways in which people find work through these networks, which

rely on relatively small pools of technicians with trusted reputations as a means of utilising existing knowledge and recreating previous success (Bechky 2006: 9; Starkey, Barnatt, & Tempest 2000: 302). For freelancers, this creates anxiety and instability in two ways, firstly creating closed shops as work is repeatedly offered solely to those already within the existing network. Secondly, for those finding themselves outside the network offering a similar service for a similar price, it became difficult to break in to such a closed market. Therefore, these networks create a large standby workforce, ready to step in and often willing to accept lower wages. For those finding themselves currently within the informal network, there is always the possibility of being dropped from it (Storey, Salman, & Platman 2005: 42). Informal networks reshaped the organisation of television labour massively in favour of production companies. Weakened unions meant that the exploitation of the ever-growing workforce became easier, and that those who were not able to meet the criteria for an attractive employee were often marginalised within these same networks (Ursell 2000a: 811-816; Caldwell 2010). Even once access has been gained to these informal networks, the effects of this new employment model are felt in the production environment. Beth Bechky has described how, in the era of temporary organisations, different members of production staff negotiate this structure tentatively through the use of profuse thanking, polite admonishment, and joking in place of frank discussion, due to these temporary organisations lacking the defined structures, rules, and codes found in unionised labour (Bechky 2006).

Sound in the New Production Environment

The changes that occurred throughout this period had a host of implications for professionals in television sound. An initial and significant effect of this new employment status thrust upon the majority of television sound operators was the fragmentation and dispersal of once closely integrated and collaborative roles in sound operation. Multiple interviewees spoke of the relationship between operators across location sound and post-production sound roles, as well as wider craft-based production roles. When working at vertically integrated broadcasters, a shared employer and place of work made fostering such relationships both easy and of free of

any financial implication. As a result, these relationships helped to establish practices, assign accountability, and encourage collaboration between colleagues from across departments, particularly between location sound recordists and those working in post-production, such as track layers and dubbing mixers. One location sound recordist commented on the relationship he had cultivated with his post-production colleagues when working for the BBC in Bristol:

> You could always go and sit in on the dub of programmes you'd done, if you were around. You could sit in and hear exactly what they could and couldn't do, it was a bit of an eye opener. It used to be a couple of days session with everyone discussing it. The opportunities were there in those days, they [dubbing mixers] liked it and they'd give you a bollocking if you did something wrong, you had to go and make your excuses sometimes, it really was a team (Sound Recordist 8).

One dubbing mixer also touched on these relationships, again pointing to them as an opportunity to assign accountability to sound recordists when in error. Although framing these relationships negatively, the dubbing mixer showed how vertically integrated broadcasters allowed sound operators to communicate and work cohesively with each other throughout the production of a programme:

> Communication between location recordists and dubbing mixers often [occurred] because something was wrong. As a mixer, I once conned my way into spending a couple of days on location with a drama recordist recording a play that used HMI lights on set [which] produce hideous interference with sound equipment [...] this recordist seemed to think that removing that in post wasn't too big of a deal but I managed to completely disabuse him of that idea. From then on he ran his cables outside, away from the lights (Dubbing Mixer 3).

In light of the now standard employment arrangements in television production, these relationships between production roles are now increasingly hard to maintain. As a result, the honing of practices and the involvement of sound operators through multiple stages of production, which had been commonplace at large broadcasters, have been lost as these roles become isolated from each other by the fragmented nature of modern television production. One location sound recordist commented on how these relationships are no longer viable in the world of freelance television production:

> If we had time, and especially if it was a prestigious programme, we'd try and follow it through and as the editor 'everything alright? any problems?' because that was the only way you knew if they had problems and you'd adapt your working process by getting that sort of feedback [...] But that's completely disappeared, now I have no idea who is editing, often the production team don't know as it can be three months down the line until they go to edit. Even if they did know, I wouldn't have the opportunity to go, and they'd be in Soho or somewhere. It's not like going into the same base and just going down the corridor to have a chat (Sound Recordist 1).

A dubbing mixer also pointed to the shift to freelance employment as a factor limiting the success of these relationships in the new television production environment:

> Some sound recordists are great and they will go the extra mile or follow up and ask for feedback. But, of course, a lot don't and most of the time it's due to them being on to the next job by the time I get hold of the location sound. They can't be too involved because they have to move on to the next job (Dubbing Mixer 1).

Furthermore, a number of post-production sound operators spoke about the distancing of roles experienced between themselves and picture editors as a result of freelance working arrangements, one dubbing mixer stated:

> In those days when it was all mostly in house BBC programmes, you'd have editors on the floor below us and so you'd pop down have a brief look at a sequence, they might ask your opinion on something, various questions. There was communication in the first place because they were in the same building as you…eventually that dropped off, editors stopped coming to the dub and sound editors have since been dropped and don't come to the dub because the production can't afford to pay them [...] it does work better if you've got your editor and sound editor in the dub, but these days with time constraints and money constraints we know that doesn't happen (Dubbing Mixer 6).

A dialogue editor suppported this point:

> The actual bumping into people in the corridor is gone. Now, most of the time they've since gone back to London and so communication can be hard, it feels too serious to phone or email about tiny little things [...] so it becomes a system in which something might come up in the script, which might then make it to the edit, which might make it to the dialogue session which might make it to the dub. But, that depends on a lot of people remembering to pass it on (Dubbing Mixer 8).

Clearly, those working in operation sound roles now feel increasingly isolated and removed from their colleagues. Although this does not stop operators from implementing their own distinct working practices, it does present a number of complications for those in operational roles. Foremost, the severing of these links between operational personnel deprives them of the ability to collaboratively tackle issues and to hone professional practice. In a number of the examples given above, these relationships presented opportunities for operators to proactively air their grievances with one another in a productive manner. Such communication also provided opportunities for operators, particularly location recordists, to receive feedback and adapt their future working practices accordingly. Furthermore, direct lines of communication removed uncertainty from the work of the succeeding personnel in the production chain. The ability to have a casual interaction with a familiar colleague by "bumping into someone in the hallway", as opposed to more formal communication with a potentially unknown party, helped to foster a better understanding of the other's working processes. Both this symbiotic understanding and these open channels of communication helped to add cohesion to otherwise separate and distinct practices. Clearly, communication between sound personnel and an understanding of their separate roles still exist among those working in television sound; however, in the now freelance-dominated employment market, these relationships are becoming harder to maintain.

Significantly for this chapter, the disruption of these open channels of communication and the distancing of sound personnel from one another are factors contributing to why sound

operators feel that their standing in the production hierarchy and their identity as skilled workers have been marginalised over time. When employed at vertically integrated broadcasters, those in craft production roles had the opportunity to follow the development of a programme beyond the definitive boundaries of their professional practice. Working in an environment that fostered communication and collaboration between separate departments presented sound operators with an opportunity, albeit a very limited one, to be involved in processes beyond their role and to influence potential decisions in other areas. However, in the contemporary environment of freelance television production, these roles are segregated and the relationships between those occupying them are severely restricted. As a result, those in operational roles are now stripped of any opportunity to exert even a small influence on the production of a programme beyond their clearly defined role. As a result of freelancing in operational roles, producers and other above-the-line staff are now the only personnel who follow a programme through the multiple stages of its development. While this is clearly not a direct or calculated power-grab by those in senior production roles, it is an example of how freelance employment arrangements in operational roles inadvertently concentrate power in the hands of above-the-line personnel, while minimizing the agency of those in operational positions. Those interviewed clearly demonstrated how a reduced relationship with other personnel in the freelance production industry resulted in a sense of detachment from overall programme production. While the true influence of operational sound personnel beyond their own role in vertically integrated broadcasters is highly debatable, the above-described dynamic is clearly an example of how new employment arrangements inadvertently lead to sound personnel feeling distanced from productions as a whole and marginalised within the production hierarchy.

Precarious Employment and Plummeting Pay

Beyond these broad developments occurring in working relationships, there have been number of more specific and acutely felt implications of the reengineering of television production for those in operational sound roles. In many areas of factual and documentary work, this has often led to a dramatic fall in work opportunities for sound recordists. Many producers interviewed consistently cited sound as a potential area for savings in an increasingly cost-conscious production environment. As stated previously in this study, the use of increasingly more manageable cameras in combination with user-friendly radio mics facilitated a trend in which a designated location sound operator would no longer be employed. Instead, sound would be operated by an assistant producer or absorbed into the work of the camera operator. One producer, whose work is based in factual programming and documentary such as *The One Show* (2006-Present) and *Britain at War: Imperial War Museum at 100* (2017), expressed this directly:

> There's the element of risk, sending out an AP with a camera might ruin your film completely, but with sound they will normally be ok, so it's a way of saving money whilst minimising risk. It sounds terrible but it [sound] is an easier skill (Freelance Producer 2).

As a producer working on light entertainment and factual programmes, such as *Big Brother* (2000-2010) and *Supernanny* (2004-2012) elaborated:

> When I worked at [Independent production company] we never used soundmen...for those kind of factual programmes, documentaries, entertainment factual stuff, the money got tighter and tighter and tighter and sound got squeezed out first...The immediate cost cut was sound (Freelance Producer 3).

Both in drama and outside broadcast production, sound roles, both in production and post-production, remain in place in the majority of shoots. However, the shift to freelance employment practices has led to considerable anxiety surrounding the security of future work, as well as a perceived decline in the position of sound operators as respected craftspeople in the production hierarchy. Interviewees commonly state that anxiety surrounding the loss of future work has the potential to impact on their conduct during production. Many state that, when working freelance, the perceived risk of losing work or developing a reputation as being awkward outweigh the rewards of speaking up in search of the best sound. One sound supervisor, who became a specialist in the coverage of high profile sports events, such as Wimbledon and the British Open and whose first job after leaving the BBC was to supervise the sound for the 1996 Olympic Games, stated:

> You can't go laying the law down to production staff too firmly, like we used to, because you probably won't get the next job then! (OB Sound Supervisor 1).

A sound recordist, continued, stating:

> If you start grumbling you're out of the job, it's bad (Sound Recordist 5).

One senior sound supervisor remarked that while financial stability has given them the ability to take this risk, insistence on speaking up has directly led to lost work:

> If I've got six months working on, just for example, Jamaica Inn, and I think it's crap. Do I say on Day One that I think it's crap and risk not being employed for the next 6 months or keep quiet? I keep quiet don't I. Well, I've paid my mortgage off and do say things and, as a result, I do get kicked off of things (Senior Sound Supervisor 8).

These anxieties surrounding future employment have also been felt in post-production. As one senior dubbing mixer who works mostly from home on one-day projects such as *Father Brown* (2013-Present) and *Coast* (2005-Present), stated:

> Well, when you're freelance, you want to get booked the next time round and so I'm not surprised when people don't make a fuss (Dubbing Mixer 8).

Another dubbing mixer added to this, stating that the risks of losing employment impacts directly on his working practices and acted to limit the level of experimentation he is willing to implement in his mixing:

> I think you're less likely to be experimental. If you're salaried and in a secure job, if you make a mistake, well OK that didn't work but move onto the next thing [...] you've now got more at stake, you're not going to be employed again [if mistakes are made] (Dubbing Mixer 6).

It is not only the insecure nature of freelance work that often discourages sound professionals from "grumbling" when at work. In their separate works on *Jamaica Inn's* sound

troubles, Kevin Hilton (2014) and Maggie Brown (2016) have both identified that sound recordists can feel that their craft is not respected by above-the-line staff when shooting. Brown quotes sound recordist Chris Ashworth as saying "I welcome the debate. It is time to get away from the blame culture. A lot of my colleagues feel undervalued" (Brown 2016: 1). Hilton also touched on this notion, quoting sound recordist Simon Bishop as saying "Sound recordists may suggest alterations...but have no authority to insist that it is done" (Hilton 2014: 1). The sentiments expressed by Hilton and Brown's interviewees are distinctly echoed by interviewees for this research, who work in both location-based roles and wider sound personnel. One senior sound supervisor interviewed stated the following:

> The people in the room that have the power, the director and producer, are the least qualified [to make judgements on sound]. We are the ones with the knowledge but no power, we're the ones who can tell if it's a cock up but nobody's listening. It's incredibly frustrating (Sound Supervisor 6).

A sound recordist whose recent work has included dramas such as *Casualty (1986-Present)* and *Skins* (2007-2013) stated that:

> …it's really bad. I despair a bit... It's a skilled job, which you spend a long time learning, but it's not treated as such by production companies. If they can save ten quid here or ten quid there, they're delighted (Sound Recordist 6).

These sentiments are by no means limited to roles in production sound. Multiple interviewees who work in post-production, both freelance and full-time at post-production houses, spoke about they feel undervalued and pressured by those in senior positions, in the words of one dubbing mixer

> You always feel in the way really, you give them this list of dialogue that needs doing and you can tell you're just creating problems for them. Sometimes a director, or even actor, might try and tell you 'oh we don't need to do that', at best you might convince them to do one take (Dubbing Mixer 1).

A dubbing mixer in full-time employment working on prestige drama and documentary, such as *Dr Who* (2005 - Present) and *Human Planet* (2011), echoed this feeling of frustration:

> The respect for the craft has gone. They make you feel like a dickhead really, if you say you can't understand something they look at you as if you're mad, but it's because they know the script and have listened to it a thousand times, but if it's my first time listening and I can't understand it, that should signal a problem (Dubbing Mixer 7).

Another dubbing mixer, again employed full-time at a post-production house working on well-resourced programmes such as *BBC Proms* (2013), *Torchwood* (2006-2011), and *Up-stairs Downstairs* (2010-2012), also discussed his relationships with producers and senior members of the production team. Giving a specific example, he illustrates the pressures put on operators to comply with the will of senior production personnel:

> I was working with an exec in on the dub once, a really high up guy on a big drama, and he just kept asking me to turn up the music and eventually I caved and I did [turn up the music] and of course you couldn't hear any of the dialogue, but he loved it. When he left I actually turned it back down again, I couldn't face my colleagues who had spent weeks on the dialogue and just tell them 'oh sorry you can't hear any of your work be-cause I turned the music up so loud (Dubbing mixer 5).

A freelance dubbing mixer, specialising in dubbing natural history documentaries, whose recent work includes programmes such as *The Life of Mammals* (2002-2003) and *Life in Cold Blood* (2008), simply stated:

> The respect for craft has slipped, partly because people think that they can do it all, because they have the technology on their laptop (Dubbing Mixer 6).

Clearly, sound operators now feel undervalued by others in the production hierarchy. As evidenced by the range of content on which these interviewees work, this experience is not limited to any one type of programming or operator. Even professionals with considerable CVs working on high budget dramas and documentaries now have to carefully negotiate their working relationships. Not only do they have to avoid earning themselves the label of being 'awkward', but they can also often find their concerns dismissed by directors or producers, who hold the senior position, if they do raise an issue related to sound quality. In an industry in which personal reputation and the quality of past work are fundamentally important to gaining future employment, the job of the sound operator has become increasingly precarious to navigate.

The feeling of disregard for craft skill seemingly goes beyond the television industry. In an open letter published on its website, the Association of Motion Picture Sound has also commented on the existing disconnect between the work of sound professionals and the above-the-line personnel who employ them. The letter pointed to the breakup of the major studio system, and the prevalence of freelancing in film production, a situation similar to that which occurred in television:

> We are too often frustrated by the state of conditions that now exist on most sets...Sound mixers are often perceived as pests or even a hindrance to the film's progress. We don't like being put in this untenable position because it is humiliating and unnecessary (Coffey, 2008).

To compound this sense of being undervalued and the anxiety over future employment, sound operators also now have to negotiate increasingly low rates of pay and deal with what constitutes a real threat to their level of income. The lack of respect for sound as perceived by the interviewees mentioned above clearly takes tangible form in the amount productions are willing to spend when hiring sound personnel. Interviewees for this research commonly touched on the cutting of rates in the freelance production economy, arguing that producers' desire to save money often outweighed the thought given to the efficient capture of sound, as one freelance dubbing mixer recounted:

> I was talking to a producer in Manchester about a project and he seemed really impressed with my background in both drama and factual programming and was keen to hire me. But, my day rate is £350 and they can find young people out of uni who are good at using Pro Tools who will work for £100 a day. So, although I have all these credits and a good knowledge of actually mixing outside the box, I'm just too expensive sometimes (Dubbing Mixer 1).

A location sound recordist made similar comments regarding the slashing of rates offered to experienced personnel:

> You often get phoned up for a job and they'll ask what's your rate, and you tell them 300 quid and the response is 'oh we never pay that, we only pay £150'. Who can you get for £150 that knows anything or has any experience or any skills? And of course, they want you to work every hour of the day, you could end up working 18 hours and be gettting well below minimum wage (Sound Recordist 6).

An OB sound supervisor also commented that the rates being offered for work are now considerably lower than in previous years, describing how the rates being offered by production companies can be as low as 50% the standard rate:

> For the FA cup match I just did, I got paid £440 per day for two days. When doing something like Springwatch it's £400 a day on transmission days and £350 for planning days, that's how much I charge. So when someone phones me up and says 'we've got this job and we'd like to pay you 200 quid', I just laugh really. It's particularly bad for recordists, you pay out about 5 grand to get your kit together, then the skills you have and carrying around that lot, it ought to be worth £300 a minimum. But the standard offer is now between £150 and £200 a day (OB Sound Supervisor 8).

Another freelance dubbing mixer again illustrated the increasingly low rates offered by production companies to those in sound roles:

> Sometimes a production will come to you and say 'we've only got £50 left for post-production sound' and, in those cases, you just have to say, for £50 you're really not going to get anything at all. Obviously, that's an extreme example, but it does happen (Dubbing Mixer 2).

Clearly, for those in sound roles, the in-built competition in freelance work has led to plummeting rates of pay, even for experienced senior operators. In the freelance production environment, which is characterised by casual networks, there is an increasing pressure to take work at lower rates or risk being replaced with competitors willing to work for less. While falling rates are not unique to sound operators in freelance television production, in conjunction with the perceived lack of respect for their work, it is a significant factor in the marginalisation of sound in the overall production hierarchy. Sound operators are, of course, attempting to earn a living via the skills and the knowledge they bring to a production. The lack of respect for their craft that they experience in their daily working life is undoubtedly a source of great frustration for many interviewed in this research. However, it is the significant fall in the financial value placed on their work that is most acutely felt by those who make their living working in television sound.

Feeling undervalued allied to the continued financial pressures of freelance work is, of course, not limited to sound. As Jonathan Bignell (2004) pointed out, "tensions, power struggles and ulterior motives are endemic to television production" (Bignell 2004: 140). More recently, Miranda Banks (2009) brought attention to the perceived undervaluing of costume designers in Hollywood, who state they often have their craft marginalised and likened to glorified shopping, even by others in craft roles. While seemingly not alone in their experiences, the testimonies of sound personnel interviewed make it clear that this new working environment has had a significant impact on both their working practices and the value placed on their craft in the production hierarchy. Their concerns are duly vindicated by the contextual accounts from producers, the "predominant authority" (Bignell 2004: 139) in television making, which depict the perception of sound as a lesser skill and an easy target for cost cutting. While those working in sound feel undervalued, both financially and socially, within the production hierarchy, speaking out about issues affecting their job can have a detrimental impact on their professional and economic well-being, as the market becomes ever more competitive and cost aware. Furthermore, when directors and producers are unwilling to listen to the concerns of their sound operators, these operators have no management structure with which they can further pursue their concerns. The responsibility for sound is now borne by a collection of

fragmented operators who must conduct their work within a hierarchy that is increasingly hostile to their skills and practices. As a result, sound operators have had to adapt significantly to this new working environment. As the following chapter will show, this has undoubtedly had a marked effect on how these operators conduct, think about, and project their work and professional image.

Creativity

The final chapter of this thesis investigates how the skillset and professional identity of those working in television sound roles have altered in light of the many drastic changes to their working lives over the last three decades. Throughout this thesis, analysis has been put forward as to how these wider industrial and technological developments have impacted on the sound operator's role in innovation, the way they interact with the tools of their trade, and the way they coexist with their colleagues in the wider production hierarchies. This study will now look more closely at how, in the context of the many developments explored in the three preceding chapters, those in operational sound roles now think about their work and construct their professional identity. This chapter argues that those working in sound in British television have seen a distinct increase in the value of creative and artistic skills in their daily working practices, as these technological, industrial and perceptual factors have shifted their professional identity from that of an engineer to that of an artist.

While the majority of this thesis has taken a broad approach to analysis encompassing numerous sound-related jobs, for the sake of clarity, this chapter focuses primarily on those working in post-production sound. In television production, sound covers a multitude of individual roles, comprising a massively varied set of skills, practices and working environments. As a result, the experiences of, and reactions to, wider industrial and technological shifts manifest in differing ways and to varying degrees within these individual roles. Therefore, focusing on post-production roles for this chapter not only aids in the succinct delivery of findings, but also enables analysis to focus on sound roles in post-production, which are, as this research has found, the jobs in which this shift in professional identity is most notably apparent.

As detailed in Chapter 2, for sound, the term post-production itself incorporates a number of distinct and complex tasks, such as additional dialogue recording (ADR), dialogue editing, foley, effects recording, and the final mix, known as the dub. Post-production sound is one of the last processes to take place in the assembly of a television programme before it is delivered and broadcast, and it is here that location sound is treated and polished to a broad-

cast-worthy standard. During this process, unwanted sounds are removed, while others, such as music, effects, and atmospheric sound, are added, thus turning a collection of inconsistent and disjointed recordings into a coherent soundtrack. In the current television market, the resources allocated to these crucial tasks varies dramatically, from none at all for web-based news inserts, a day with a solo mixer for a modestly-sized daytime drama such as *Doctors (2000-Present),* or as much as 10 weeks with a team of 5 working on a primetime drama such as *Dr Who (2005-Present)*.

The technologies and working practices of post-production sound in television have seen monumental shifts over the last four decades, most notably the development, and then complete industry adoption of, digital audio equipment. No sound-related profession has felt the impact of digital technologies as profoundly as those working in post-production. Equipment that once took up entire rooms in sound departments has been replaced by software that can be run on laptops. Processes that would have taken minutes or even hours on earlier equipment, and which required careful planning, can now be carried out in seconds, almost regardless of error or negative consequences, due to the ability to instantaneously undo and redo. Digital post-production technologies blur the lines between once distinct job roles and disrupt the existing hierarchies of post-production (Caldwell, 2008; Beck, 2008). Of course, alongside these technological developments, those working in post-production sound have had to negotiate the same problematic industrial reconfiguration as any other production-based personnel.

As discussed in the previous chapter, those working in post-production sound have, along with those working in sound roles more generally, seen their place within the production hierarchy threatened by those occupying positions of power in that hierarchy. The British television industry has been through a period of unprecedented change characterised by the move away from vertically integrated producer-broadcasters, a growing independent sector, increased market competition, and increasingly informal and insecure employment production practices (Storey et al, 2005; Ursell, 2000b; Born, 2004; Tunstall, 1993; Starkey et al, 2000). For those occupying these roles in sound, justifying their place, and cost, on a production is

now increasingly important, in what Ann Gray described as “a volatile and dynamic industry in a period of uncertainty” (Gray, 2010, 60)

This chapter argues that those working in post-production sound in British television have seen a distinct increase in the value of their creative and artistic skills in their daily work as technological, industrial and perceptual factors shift their professional identity from that of an engineer to an artist. Developments in the form and affordances of new editing and mixing technologies, changes to training, and the move towards freelance employment have led to a gradual but profound change in the skillset and professional identity of those working in these positions. The new post-production environment has expanded creative possibilities while alleviating users of the more cumbersome practical elements of their work. It has been argued by some (Kealy, 1979; Quanz, 2015; Gray, 2010; Mayer, 2011; Dover, 2004) that notions of creativity and professionalism are often used strategically by those working in the increasingly competitive and unforgiving film and television industries as a way to increase desirability. The promotion of their creative input allows post-production sound professionals to protect themselves from what Caldwell has called the “backdoor workforces” of computer-literate multitasking media graduates willing to work for lower pay (Caldwell, 2010). However, the perception of increased creative capabilities seems to be a common experience among almost all of the interviewees for this project, regardless of the span, stability, and status of their career. Both the Bafta winning dubbing mixers on permanent full-time contracts at elite post-production houses and the freelance dubbing mixers working from home on short often one-day projects stressed the increase in creative opportunities and the distinct changes that have occurred to the identity of those who make up the profession. Additionally, throughout this research, it is clear that creativity is now synonymous with job satisfaction. To achieve a better understanding of this phenomenon, research must engage not only with the industrial shifts of this time period but also with the ways in which sound operators think about and communicate their work to the wider production community.

This research aims to provide a greater understanding of the changing professional identity experienced by those working in the environment of post-production sound in British

television. In doing so, this chapter will thus analyse some of the major technological evolutions that have been instrumental in facilitating shifts in working practices, after which it will present analysis of how these technologies and wider industrial factors have reengineered the professional identity of dubbing mixers in a way that allows them to distance themselves from previous generations of their profession through notions of creativity. This notion of creativity will be explored in the context of production studies research on creativity in below-the-line 'craft' positions in order to examine whether such professional identities exist in an exclusivist sense (Negus, 1999) or simply as a means of defence against continuing industry constraints.

While little research has been conducted on post-production sound in television, research on the music industry cites a shift towards a creative professional identity that dates back to before studies of television sound had been properly established. In his 1979 article *From Craft to Art: The Case of Sound Mixers and Popular music,* Edward Kealy argued that, due to a combination of new technologies, new musical forms and industrial shifts, the professional identity of sound mixers in the music industry changed dramatically. In the period directly following World War Two, the work of the sound engineer in the music industry was characterised by what Kealy calls a 'craft union mode' of working (Kealy, 1979). These engineers had technical backgrounds, were heavily influenced by union activity, and worked predominantly in large bureaucratic studios. Technologies of this period were utilitarian and "did not offer the sound mixer a wide range of discretionary choices during the recording" (Kealy, 1979, 7).

As television gained popularity, radio was forced to adapt in service to musical audiences. In addition to this, the reduction in price of recording technologies led to new music studios opening in large numbers. New multi-track tape recorders enabled the separation of two crucial stages in the music production process - recording and mixing. A new generation

of musicians therefore had the ability to be in the room and express their opinions over the mix, changing "the occupational ideology for sound mixing; work previously considered merely technical now became artistic." (Kealy, 1979, 13-15)

This above described sentiment has been echoed in later writing about the place of the sound mixer in the music making process. In her 2004 issue of *Social Studies of Science* dedicated to sound studies, Susan Horning argued:

> During the 60's, the studio became an instrument in its own right, which musicians and producer-engineering teams exploited to create new sounds rather than just capture them (Horning, 2004, 704).

Increasingly, sound mixers had to prove their worth or risk being ousted by technically literate musicians. Sound mixers could no longer claim ownership of "aesthetic resources" and consequently had to rebrand themselves as "aesthetic collaborators" (Kealy, 1979, 16).

For those working at newly opened studios and working outside the protections of the major label studios and union regulations, this led to a working culture similar to that seen amongst the television freelancers of today. Job opportunities became linked to the success of previous projects, and job security became a luxury experienced by few. In this new production environment, recording engineers were increasingly projecting a professional identity as a creative contributor in order to maintain their status.

In 1985, Marc Mancini made a similar assertion with regard to film sound, and the emergence of the term 'sound designer'. Mancini argued that a combination of industrial and technological factors in film production led to the development of the role of sound designer'. He goes on to describe how those employed in this capacity are responsible for the overall creative direction of the soundtrack and to compare the role to that of cinematographers or production designers. Mancini argues that these factors effectively rebranded the sound de-

signer's professional identity, and, in so doing, distances them from their previous image as technical craftspeople:

> Decades ago they may have been called supervising sound editors, but that title has a craftsy connotation that down plays the true nature of their job: they are aural artists (Mancini, 1985, 361).

In recent years, however, Jay Beck criticised Mancini's work as a disservice to the evaluation of changing roles in film sound (Beck, 2003; Beck 2016), arguing that Mancini's retrospective application of the title sound designer reduces the role to that of a glorified sound effects editor, only one of the many responsibilities of post-production sound. Beck goes on to state that Mancini gives little thought to the practical functions of the role or to the industrial developments that have occurred throughout the Twentieth Century, particularly the shift away from the vertical hierarchies of the studio system. He argues that, in fact, due to the strict hierarchies, divisions of labour, and strong unions within the studio system, it was not possible for any one person to act as a sound designer. Beck goes on to argue that the "Loosening labour structure [...] and the decline of the studio system created space for such sound auteurs" (Beck, 2003).

In recent years, there has been a growing interest in post–production, on the part of production studies researchers, across of a range of 'craft' roles. As detailed in Chapter 1, John Caldwell showed that developments in user-friendly software-based post-production tools in combination with the rise of boutique post-production houses has led to the rise of 'backdoor workforces' and 'digital sweatshops' in Hollywood's post-production industry (Caldwell, 2008). Mark Kerins added to this line of thinking, arguing that, in the "surround sound age", production companies often find themselves "throwing bodies" (Kerins, 2011, 151) at a soundtrack. Kerins argued that this new tactic is undoubtedly linked to the shortened timeframe dedicated to the sound track due to the affordances of digital editing technologies, resulting in large teams working relentlessly on the soundtrack in an effort to make up the shortfall in time. With so many working simultaneously on sound, the creative capabilities of

any individual are severely restricted. Caldwell (2008) showed how modern day Hollywood makes use of both Fordist style production characteristics, in maintaining large unionised workforces in a roughly centralised location, and post-Fordist industrial strategies, such as downsizing and using flexible labor. Clearly, the work of post-production personnel and the digital sweatshops that employ them is an example of Hollywood maintaining its Fordist production line characteristics, within which there is little scope for personal experimentation and creative satisfaction.

The exact implications of the shift to digital post-production practices remain disputed. In contrast to Kerins' work, Benjamin Wright (2011) has argued that the ease of use and relative speed of digital audio workstations has actually resulted in a reduction of the resources available during post-production. Agreeing with the consensus that digital audio workstations facilitated the reduction of resources allocated to sound, Wright argued that a project that would have taken the work of twenty-five people can be completed by a crew of as few as five. Furthermore, he contends that the use of DAWs in fact compounds the image of sound professionals as engineer-technicians rather than creative contributors:

> Sound practitioners have long been associated with the role of technician, as manipulators of technology and knob turners with no real artistic licence. The proliferation of digital tools has intensified this attitude (Wright, 2011, 126).

Wright has contended that sound editing and mixing remain creative processes that maintain an "emotional connection between practitioner and film" (Wright, 2011, 149) in spite of these technologies rather than as a result of any new extended affordances they may present. Wright argued, in contradiction to many other scholars on this subject, that the proliferation of digital technologies has, in fact, hampered the professional identity of post-production sound operators and has acted to suppress notions of creativity in their work.

Additional research in the area of post-production sound has shown the effects of geographical and industrial specificities when introducing technologies into individual production environments. Quanz (2015) showed that the introduction of cheap DAWs into the oversaturated Canadian market resulted in waves of redundancies, pay cuts, and outsourcing (Quanz, 2015). In direct contrast to Wright's assertions on professional image, Quanz argued that, in this new production environment, the projected identity of sound personnel as technicians was quickly suppressed in order that the "craft and artistry of soundtrack production were brought to the fore" (Quanz, 2015, 45). In keeping with Kealy's (1979) original point, those working in post-production sound were no longer able to claim exclusive control over their professional tools. By promoting creativity and artistic ability, those in the industry were able to protect themselves from the infiltration of young low-paid newcomers looking to establish themselves in the industry by almost any means.

Clearly, the implications of these new technologies, practices, and industrial circumstances manifest in specific ways within individual geographic, economic, and industrial environments. However, these developments and their implications in Britain's distinct television production ecosystem remain under researched. This chapter argues that, in British television, these developments did not lead to deskilling, as described by Caldwell, but rather a redistribution of skills, moving from the paradigm of an engineer who maintains and operates complex pieces of equipment towards a 'creative' who makes artistic contributions to content. This chapter aims to build upon Quanz's work on Canadian film, examining how those working in post-production sound in Britain's television industry now view their work and professional identity in light of significant industrial and technological change. As will be discussed below, this group of professionals experienced a genuine extension to their practice, which was welcomed by early adopters, who viewed themselves as both creative and experimental. This extended practice developed over a long time period and was apparent to those working in what was, at the time, secure employment at large scale bureaucratic organisations such as the BBC.

Technological developments in Post-Production Sound

It can be tempting to analyse the increasing importance of creativity in sound production practices simply in relation to the software-based DAWs of the present era. These systems have undoubtedly contributed to this shift, particularly due to their democratising effect on the the tools of post-production sound. However, this shift in professional practice can be traced back far beyond the introduction of software-based DAWs and has been facilitated by many previous generations of technology. Significantly, these technologies were often neither cheap nor easily accessible, as is often asserted in relation to the notion of deskilling. For many decades, these technologies meant that broadcasters and production houses would have to make significant capital investment, which were far beyond the reach of the average freelancer or recent industry entrant.

One of the most prominent examples of an early digital technology impacting on practice is fader automation. Fader automation allows for fader movements to be stored and then recalled throughout a mixing session, meaning that dubbing mixers can set levels for the individual aspects of a mix, such as dialogue or atmospheres, individually and then store any subsequent changes. When moving on to the next aspect of the mix, the automation system controls the faders of the channels previously worked on, recalling their movements automatically, and freeing the dubbing mixer from the need to physically move all the faders at all times. This allows the dubbing mixer to focus on a particular task at hand without having to divide attention between several simultaneous activities. The first company to offer automated fader desks was Neve Electronics. By the mid 1970s, Neve, at this point operating as an independent company, had established itself as one of the leading providers of mixing desks to music, film, and broadcasting. At that time, the BBC had begun to replace its in-house designed desks, such as the Type D (see Chapter 2), with desks made by third party manufacturers. In 1976, Neve debuted its NECAM (Neve Computer Assisted MixDown) system, the world's first moving fader automation system, at the 54th convention of the Audio Engineering Soci-

ety. Using a timecode embedded on the tape, NECAM interfaced between the desk and tape machine, allowing instructions to dictate fader placements at any point during playback, with commands entered via keyboard and stored on floppy disc. NECAM also allowed for a host of other functions, such as drop-ins, fades, and the grouping of multiple faders together so that premixes could be conserved within the wider mix. In a 1976 issue of *Studio Sound*, contributor Michael Thorne wrote:

> For the first time the link between multitrack tape machine and mixer becomes more than a human connection. This is where possibilities far beyond conventional techniques begin to open up (Thorne, 1976, 14-15).

Discussing the original NECAM system in an article for *Studio Sound*, Gordon Skene and Ray Carter wrote:

> One can take the introduction of the automated system two ways: first it provides an avenue for the engineer to free his mind from the demands of the mixdown and assume a more creative role in another part of the session; or secondly, by creating a foolproof area of operation make the area open for a sizeable chunk of idiots turned engineer so to speak (Carter & Skene, 1976, 58).

Orders for the original NECAM system were slow, due to the $100,000 price tag (estimated to be worth more than $400,000 as of 2017) and the nine-month production cycle (Carter & Skene, 1976, 58). Most of the first systems went to music studios, including Air Studios and the Music Centre with the very first NECAM being installed at Air in 1977 (AMS-Neve, 2016), although, by 1985, Neve received orders for the NECAM 96 system, the third generation of Necam released in 1984, from BBC Television, the BBC Film Department and Birmingham's Central Television (Studio Sound, 1985, 36). In 1988, Neve collaborated with Californian company Martinsound on a new fader automation system called Flying Faders. While Flying Faders had been in development at Martinsound for a number years,

they lacked the manufacturing capabilities and industry reputation required to get the system off the ground. Neve's product manager at the time, Roger Cameron, suggested that Neve's acquisition of Flying Faders was a tactical one, as the "speed and general performance of Flying Faders is so vastly superior." (Cameron, cited in Stapely, 1991a, 46). Having both acquired Flying Faders and developed an appropriate user interface, Neve rolled out an aggressive strategy of retrospectively fitting Flying Faders to those wanting the system on their existing Neve consoles, in an effort to cement the company's place as an industry standard for computer-based fader automation (Stapely, 1991a, 61).

Neve was not alone in offering automation systems, with competitors Solid State Logic (SSL) also being early adopters of automation. Its SL4000 series mixing desk had already become a market leader in music production when the release of the broadcast-specific SL-5000 desk led to SSL becaming a significant name in television production and post-production. These desks came equipped with SSL's *Studio Computer*, which provided both fader automation and a system called *Total Recall*, comprising a monitor display of the settings of numerous functions, such as EQs, panning, and submixes, enabling them to be accurately reset by hand. In effect, Total Recall offered a crude precursor to digitally assignable desks. In 1991, coinciding with the release of Neve's Flying Faders, SSL released an improved automation system, Ultimation (Stapley, 1991b). Furthermore, Calrec, another leading mixing desk manufacturer, offered automation in the form of their LX800 automation system. This meant that, by 1980, all three of the market-leading desk manufacturers in Britain were offering automated fader desks.

Chapter 2 detailed the working practices of dubbing mixers using non-automated desks, which was highly stressful and required significant skill and attention. However, the advent of fader automation meant that a mix could now be separated leaving the dubbing mixer to focus on individual tasks rather than attempting to juggle the whole mix at once. When interviewed, one ex-BBC dubbing mixer, now working freelance, stated:

> Automation allowed slightly less talented people to do more complicated things, as it took some of the things you would have had to remember and repeats them. It also allowed for you to build a mix in stages, in chunks you could cope with, and that's no bad thing (Dubbing Mixer 2).

This point is further reinforced by a dubbing mixer, who also directly references automated desks as a development that relieved dubbing mixers of the stressful and time-consuming elements of their work:

> If you've got an automated console, even just faders, you can take a part of that, get most of it right, and go back and alter only the bits you've mucked up. This is massively less stressful than knowing that sooner or later you have to get it right (Dubbing Mixer 3).

The remarks from these interviewees are in keeping with the arguments made by Carter and Skene 40 years ago. While, clearly, automation did not create a 'foolproof' system which enabled anybody to mix successfully, it did mean that dubbing mixers did not have to dedicate the bulk of their attention on the performance of a perfect run-through. The removal of this 'theatrical' aspect of mixing undoubtedly eases the pressure on the dubbing mixer, who knows that their mixing will be preserved no matter how many run-throughs or mistakes are made. Fader automation undoubtedly freed a great deal of a dubbing mixer's mental capacity and allowed, as Carter and Skene state, for this to be reassigned to the creative and artistic properties of the programme soundtrack.

The integration of computer technology into mixing desks soon gave way to the development of digitally assignable and fully digital desks. Digital desks offered considerable advantages over analog desks in terms of usability and size, meaning that it was no longer necessary for each signal to have its own distinct channel with multiple signals operated by one

fader and multiple functions controlled by one knob, thus considerably reducing the size and complexity of desk layout. Furthermore, digital desks offered increased flexibility, as signals could be rerouted quickly and easily without changing the physical cabling. Settings could also be stored on disc and recalled at the start of individual sessions, representing a considerable time saving. While a fully digital desk converts the audio signal into digital form[8] on input, the audio signal remains analogue with a digitally assigned analogue desk, while routing, effects, and channel setup are performed digitally.

Fig. 20: Neve DSP - the world's first fully digital desk (Image: Pro Audio Europe, 2017)

[8] Unlike analogue systems, in which the sound signal remains an electrical signal throughout the entire recording process, digital devices use pulse code modulation (PCM) to sample and then digitally represent this signal as binary data. PCM usually samples a sound wave at many times the frequency of the soundwave (the current standard being 48kHz) and records a certain number of bits for each sample (the current standard being 24 bits, although early systems were normally 16 or even 8 bit). The sample frequency and bit depth used when recording dictates the accuracy, or fidelity, of the digital representation of the sound wave recorded. Once in digital form, sound can be copied without concern for degradation as the data is only a representation, not the sound itself. PCM is the standard form of digital audio and can be used to represent many forms of analogue data beyond just sound. The conversion from analogue to digital in digital devices will occur on input, where an analogue-to-digital converter converts the analogue electrical signal delivered by the microphone or another analogue sound source. When working with digital mixing desks, this conversion will either happen, again, on input into the desk, or the sound may already be in digital form if the desk is playing off digital tape rather than traditional analogue tape, or mag film. These signals are then reconverted, or demodulated, at the output for sound to be heard as sound.

In collaboration with the BBC, Neve developed the first fully digital desk, the DSP, in 1980 (see Fig. 20). The DSP was a landmark feat of engineering but failed to gain widespread market success due to its price, complexity, and the lack of a market for such a product. One commentator in *Studio Sound* stated that the DSP failed to "transform the situation; like Concorde it flew as designed, proving it can be done, but like Concorde no ordinary mortal can contemplate using it" (Swettenham, 1991, 29).

During the same period, Calrec collaborated with the BBC to develop a digitally assignable desk, although the resulting desk never entered production. Solid State Logic also discovered the difficulties of developing a digital desk when, in 1988, it released a digital desk, the *01*, at the AES convention in Paris. The desk suffered such severe problems that it was subsequently withdrawn from the market and its six initial buyers were refunded (Spencer-Allen, 1988; Andrews, 2007). However, with time, workable digital desks began to enter into production. After buying Calrec in the hope of gleaning expertise in digital desk design, Burnley based AMS entered the market with its Logic 1 system, a fully digital mixing console built around the Audiofile digital workstation, the precursor to the successful Logic3 system referenced in Chapter 4. Neve also began work on redesigning the DSP, and, in 1992, released its new fully digital desk, Capricorn. At this time, both Neve and AMS were bought by Siemens, and, in 1992, merged to become AMS-Neve. In Logic and Capricorn, AMS-Neve effectively had competing products, which led to some anxiety among customers considering making large capital investment in products that could have been discontinued in the near future. It was, therefore, decided that the Logic series would focus exclusively on the post-production market, while Capricorn was marketed for the music industry (Andrews, 2006; Andrews, 2007; Scheope, 1993). A year prior, Calrec and AMS had parted ways, making Calrec an independent company which soon found success first with its digitally assignable T series and then the (fully) "Digital T" in 1994 and 1997, respectively (Scheope, 1998, 42). By the mid-1990s digital desks were becoming the norm in post-production sound, with AMS-Neve and Calrec leading the industry (Hilton, 1994, 85).

For those working in post-production sound, digital desks considerably streamlined working practices. Smaller more manageable desks meant that one person operation was now easily achievable, while the ease of changing desk configuration removed a complex and tedious task from the process. One dubbing mixer stated:

> With digital desks you can just easily change where something is. I can have whatever channels I want here or there, so it takes so much less prep and planning time (Dubbing Mixer 1).

Clearly digital desks facilitated a shift away from technically focused practices by streamlining the hands-on activities of mixing without losing any functionality. While an analogue desk with a large number of faders may have been many feet long, a digital desk could retain this functionality at a fraction of the size, as, theoretically, only one fader is required. When using large analogue desks, it would be common practice to have (at times multiple) assistants mixing a number of channels simultaneously alongside the dubbing mixer. Furthermore, assistants would be responsible for the complex task of routing the desk channels and signals via any outboard equipment. While, clearly, using analogue desks was a task requiring a small team of operators, as digital desks have shrunk physically, they have became more manageable and are now routinely used by a single operator.

Undoubtedly, the most prominent technological change in the shift to digital post-production has been the move to DAWs. In Britain, DAWs were introduced to the television industry early in their development. In 1984, AMS released the first DAW, the Audiofile (see Fig. 21), which, building on AMS' success with digital effects boxes, was a hardware-based 16 bit, 8 track workstation with enough memory to hold 20 minutes of audio. By 1986, track counts had risen to 16, storage capacity had increased to several hours, and AMS received their first orders from both the BBC and Television South. At first, the Audiofile found uses in a number of auxiliary tasks, such as recording overdubs and triggering pre-recorded sound effects

for ‘as live’ production. However, in 1988, AMS developed their Logic series of fully digital desks which, in tandem with the Audiofile, created a fully automated and complete post-production system (James, 2001).

Fig. 21: AMS Audiofile interface. (Image; AMS-Neve)

Fig. 22: DAR SoundStation II Interface (Image: Electronic Instrument Archive, 2017)

Coinciding with the release of Logic 1, in 1988, Digital Audio Research (DAR), headed by ex BBC engineer Guy McNally, showcased its DAW, the Soundstation II (see. Fig 22), for the first time at the AES convention in New York (Foster, 1988; Price 1989). Much like the Audiofile, Soundstation was a hardware based DAW that could be configured as a 2, 4, or 8 track machine, and offered advanced features, such as a touchscreen and waveform editing.

By 1990, DAR had amassed orders for the Soundstation from a wide range of customers, including the BBC, TVS, and Twickenham Studios. With prices starting at over £50,000, these systems meant large capital investment for even the biggest of broadcasters and post-production houses. However, once mastered, they offered significant time savings over existing analogue mixing and editing methods, with one former dubbing mixer stating:

> It wasn't cheap in capital terms, but very cheap in time and effort, because one person was doing in two or three weeks what would have taken two or three people six weeks. Audiofiles and, to a lesser extent, Soundstations, with a skilled operator, were exceedingly efficient. They were not user friendly machines, but with skill and practice you could be amazingly good and amazingly quick (Dubbing Mixer 3).

A Dialogue Editor adds to this point, stating that the Audiofile was:

> So fast and intuitive, they really got scrubbing right, you could just whiz through and edit so efficiently, better than you can with a mouse and keyboard (Dialogue Editor 1).

While British-made systems, such as the Audiofile and Soundstation, gained significant status in the British television industry throughout the late 1980s and 90s, they were not alone. Australian manufacturer Fairlight ESP, a rebranded version of the already established musical sampling company, achieved significant industry use of its MXF-3 workstation (see Fig. 23).

Fig. 23: Fairlight ESP MFX3 DAW (Image: Vogel, 2017)

American company Avid, known for its picture editing software, also manufactured its own DAW, Audiovision, which was adopted by BBC Birmingham at Pebble Mill. However, in the following decade, the market was all but conquered by the future industry-standard Pro Tools, originally developed by Digidesign. After gaining success as a producer of music production software, Digidesign released the first version of Pro Tools in 1991, using an Apple Mac rather than proprietary hardware. Pro Tools gained its success through a number of contributing factors, first of which being that the initial cost of Pro Tools was extremely low compared to other DAWs of the time. Pro Tools 1 could be bought for as little as $6,000, meaning that Pro Tools found a large market share among those who simply could not afford the high-end DAWs of the day (Hillman & Pauletto, 2016; Quanz, 2015; Wright, 2011). Despite this low cost, functionality was kept high through the use of third party accessory software known as plugins, which meant that users could upgrade the functionality of their sys-

tem as and when appropriate for them, while maintaining a flexible budget.

Multiple interviewees for this thesis touched on the pricing of Pro Tools and the use of plug-ins as a deciding factor in its adoption by the industry, with one dubbing mixer stating:

> Pro Tools became the standard because it was the first of its kind. All the others needed really expensive hardware, like 30K expensive hardware, with Pro Tools you could be up and running for five grand (Dubbing Mixer 8).

Another dubbing mixer added:

> They were the first to do third party expansions, plugins, and it makes it really versatile. Waves and Izotope were really revolutionary (Dubbing Mixer 4).

The founder and MD of AMS-Neve, Mark Crabtree, asserted that:

> Plugins were the tipping point really. They were the reason the Audiofile, which had no plugin functionality, went out of fashion and Pro Tools eventually became standard (Mark Crabtree, AMS-Neve Managing Director).

Finally, Pro Tools gained widespread success due to the relationship with Avid, the market leading picture editing software developer, which acquired Digidesign in 1995. Avid's acquisition of Digidesign had two major outcomes for Pro Tools.

Firstly it guaranteed complete compatibility between the two sets of software, eradicating the troublesome issue of cross-compatibility between picture and sound editing departments. Secondly, ownership by Avid also granted Digidesign access to Avid's large customer base, as Avid actively tried to recruit its visual customers to its newly acquired sound editing platform. This, added to Pro Tools' existing low-end client base, meant that Pro Tools' held a commanding position in the industry (Hillman & Pauletto, 2016; Quanz, 2015; Wright, 2011).

Despite amassing a considerable market share, Pro Tools was not necessarily popular among those interviewed in this research, with many arguing that it was slower and more difficult to use than the bespoke hardware systems that came before it. Many also contend that Avid was complicit in questionable corporate strategies and loss-leader selling in an effort to price-out other DAW manufacturers. Although a definitive investigation into these allegations is beyond the scope of this research, what is clear is that Pro Tools was considerably cheaper than any other high end DAW and is now the de facto standard for those working in television post-production sound in Britain, as one interviewee attests:

> There are, of course, other systems we could use, but I guess the question I'd ask is - why bother? Pro Tools is the absolute standard so why use anything else (Dubbing Mixer 7).

Another interviewee stated:

> It could well be that other systems are better, but that's not really why we use Pro Tools, everyone uses Pro Tools. If you find out someone has done a session in another programme, well, it's just a massive ball ache (Dialogue Editor 1).

And another stated

> In TV, there are a couple, maybe even three, really good alternatives to Pro Tools, but only the brave or the very self-contained will use them. But to do it in the marketplace where you are employing freelancers all over the place – be it for TV drama or film – you'd have to be a really brave sound editor to go down a different route (Dubbing mixer 3).

Clearly, for those working in post-production sound, Pro Tools wasn't, and still isn't, a perfect tool; however, it is the market standard by which the professional community studied in this research attains a level of universality. In an industry dominated by a fragmented workforce of freelancers, its compatibility and near-universal use is clearly valued more highly than the advantages that may well be offered by other systems. Furthermore, Pro Tools is the current market standard and is, thus, the technology onto which sound operators' work-based frustrations are now most immediately projected. As the nostalgia that often surrounds tools of previous eras has not yet developed, the interviewees' critiques and annoyances were more readily identifiable during discussion. However, regardless of the DAW used, there is a common theme that emerges in almost every interview when discussing the move to DAWs - their ability to facilitate creative working practices. As one interviewee described:

> The ability to change things is great. This digital world of mixing frees up your creativity, you don't get bogged down into the physical difficulties of mixing (Dubbing mixer 2).

Another interviewee made the following comment on the ability of DAWs to undo processes instantly:

> Amazing, suddenly you could undo and redo all these things, it was so creative. It was like being a painter suddenly able to wipe the canvas and start again (Dubbing Mixer 6).

Dubbing Mixer 5 stated that DAWs:

> Unlocked a vast amount of creative possibilities, current audio workstations are all that, plus all the editing stuff in spades in the form of plugins...the single most creative difference between film and a digi device is the ability to change your mind without it costing a fortune (Dubbing Mixer 5).

Clearly, for those working in post-production sound in television, the development of these technologies almost automatically brought about the facilitation and expansion of creative potential. Due to the speed of DAWs when editing, processes that would have been far beyond the boundaries of what was deemed affordable and efficient in the analogue era have became commonplace. The ability to undo and redo without incurring time and cost penalties and with no risk of degrading quality allowed the dubbing mixer to experiment beyond what would have been possible using analogue technologies. Furthermore the use of automated digital desks created a workflow that is easier, more manageable and less labour intensive than that possible working with previous mixing desks. Clearly, the technological environment in which dubbing mixers work has changed fundamentally.Based on the comments made by those within the industry, their professional practices and professional identity have morphed correspondingly. The traditional image of an audio engineer battling with unwieldy and unreliable technologies, and whose skill lies in their ability to simultaneously juggle an entire mix, no longer fits with the technological or industrial environment in which dubbing mixers work.

The Tribal World of Digital Post-Production

Along with technological development, the fundamental reform of the television industry during the late 1980s and 90s had a significant impact on the professional identity of those working in post-production sound. As discussed in detail in Chapter 2, those who have recently entered the industry have a significantly different professional and educational background to those who entered in the era of vertically integrated broadcasters. Entry to the industry is now by different means, with entrants trained in a fundamentally different way to those who received training through the residential courses provided by the BBC and the ITV franchises. Furthermore, Chapter 6 has shown that employment is now sporadic and unstable for many across television production, as the industry has shifted towards using informal networks of reputable freelancers in replacement of permanent staff. For those working in sound, including post-production roles, these developments have been acutely felt, as sound has been tar-

geted as an area for cost cutting and sound personnel have slipped down the production hierarchy more generally. Furthermore, for those working in post-production sound, the tools of their profession have become increasingly accessible to even the most casual of users, with entry-level software packages available for hundreds rather than thousands of pounds.

The pressures of working in an increasingly cost-conscious environment and the accessibility of new productions tools have undoubtedly contributed to the emphasis on creativity in the professional identity of dubbing mixers. As a result, sound operators working in post-production use creativity in an attempt to cultivate value in an increasingly hostile working environment. However, significantly, interviews conducted for this research indicate that this shift in professional image has been experienced by those who were trained and employed in large vertically integrated broadcasters, with almost all post production personnel interviewed for this research starting their careers at the BBC through the standard TO route. Of the majority of post production operators interviewed, many likened their early career to an apprenticeship before steadily working up to more senior roles. Only three of those interviewed went to university, of whom only one obtained a media-related degree with the other two having studied engineering and economics. Furthermore, this shift in professional image is not limited to those on the fringe of television production or struggling to maintain employment in an increasingly hostile industry. As shall be shown, this shift in identity has been experienced even by those in secure employment working on well-resourced prestige programming.

While the interviewees do not represent a fundamental departure from the type of individual employed in this sector of the industry before the transition to digital, differentiating themselves from the dubbing mixers of the previous technological milieu seems to be a matter of great importance to them. The vast majority of interviewees started their careers in the analogue age, and yet have managed to navigate the complex and turbulent transition into the digital era while maintaining their status and respect as skilled craftspeople. When discussing those who worked exclusively in the analogue era, or who had failed to successfully make the transition to digital workflows, interviewees often used uncharitable phrases to illustrate the difference in the skills and approaches of these two distinct camps. For those working in the

tribal world of digital post-production, being able to identify themselves as embracing these technologies, and by extension self-identifying as members of the now dominant tribe, bears great significance on how they view their work and their career.

Following their widespread adoption, digital technologies not only provided sound professionals with a host of new technological affordances, but also provided symbolic value as a tool for these professionals to distance themselves from, and assert superiority over, proponents of analogue mixing technologies. Although many DAWs gave their graphics the appearance of editing on mag stock, the integration of computer interfaces and the removal of any physical acts of cutting tape was a drastic change in the way dubbing mixers approached their work. However, it was not only DAWs that changed the way dubbing mixers interacted physically with their work. As discussed earlier in this chapter, digital mixing desks removed many of physical tasks inherent in the analogue era. No longer did dubbing mixers have to spend long periods of time plugging jack fields, routing the mixing desk channels, or loading and playing in library sounds from analogue media. Where previously dubbing mixers interfaced with the programme soundtrack using their hands, they were now using computers and digital displays that reduced complex and lengthy tasks to one click of a mouse. This is a considerable change by any standard, and one's ability to cope with this shift is seemingly viewed make or break for those interviewed. Now employed at a prominent London facility, one ex-BBC dubbing mixer, who has worked recently on dramas such as *Hollow Crown* (2012) and a considerable amount of feature film work, discussed this adaptation:

> There were lots of old ex-RAF types there who just didn't get it. They mostly came from radio and had been doing things a certain way for years on end. They said it was all kids stuff (Dubbing Mixer 5).

Another retired dubbing mixer, and ex-post production manager at the BBC, arguably consolidates this line of thought:

> There was a lot of resistance from old school film sound people because [of] their whole background...But, practically speaking it was only, and I'm being slightly unkind here, the senile who opposed it (Dubbing Mixer 3).

A third dubbing mixer, also associated with the BBC and working mostly on one-day projects, including lower end drama such as *Doctors* (2000), further supported this notion:

> Some of the older guys didn't really cope with it. They were at the end of 30-40 year careers and it was such a massive change, it's no surprise they didn't love it. But the youngsters at the time, I think they saw it was the way forward and loved it (Dubbing Mixer 8).

Clearly, coming to terms with the tools of the digital era was an inevitable hurdle that any dubbing mixer unable to retire at the time of the digital roll out would have to clear. However, it is clear that this ability to learn new practices, in the face of massive technological change, held symbolic value among those who successfully traversed this period. This successful adaptation acts as an important signifier of skill and ability that dubbing mixers use to differentiate themselves from the past era of professionals, whose tools were seen as cruder and less refined than the new digital technologies. The ability to use digital technologies is an important tool dubbing mixers use to differentiate their work from those working in the engineering-intensive analogue era. However, above all, it is the ability to use these technologies in a creative, even artistic, way that truly separates the old from the new. Interviewees who worked in the digital era were keen to express that it is their creative skill that makes mixing

in the digital era and, by extension, themselves, inherently better than what came before. They alluded to tacit knowledge or skills that have been freed by the technological affordances of digital technologies, such as the ability to put flair, personality, or musicality into a mix in ways that previous operators could not. One interviewee, who works primarily on small-budget daytime drama, stated:

> You get some of the old boys like [Colleague X] who were used to just mixing [in the analogue era] and they were very functional, you always got a functional mix but they didn't add that flair or that creativity. They didn't really build a story or add their own style to it, it was just a good standard mix (Dubbing mixer 1).

Another dubbing mixer, who works exclusively on high-end BBC drama, including *Dr Who* (2005-Present), solidified this point:

> Nowadays you have to know music to be a dubbing mixer, [Colleague A] is a musician as where [Colleague B] isn't, and you can tell it in his mixing, you really can. I think a different type of person does the job now, before they were definitely BBC engineer types, now it's musicians and that sort. Some of these old BBC types couldn't even count to 4, let alone know how to edit music in a complicated time signature or creative way (Dubbing Mixer 7).

Such comments give clear insight into the distinctions dubbing mixers make between themselves and their forebears. These statements are, at best, laced with negative connotations and at worst thinly veiled insults. For those interviewed, the tribal divisions within post-production are clear, between those who "saw the way forward" of embracing digital technologies and those too senile to adapt. Clearly, the dichotomy presented by the interviewees is, at

least to some extent, exaggerated. However, it is clearly important to understanding the way dubbing mixers think and talk about their work and the work of those who came before them, particularly when discussing this with someone from outside of their professional environment.

Artist or Salesperson - Investigating notions of creativity

> I suppose I could have gone the route that a lot of people do and work for a bank after I finished at Cambridge but, well, I didn't want to do that. I did really love economics, I thought it was a great thing to study, it was really interesting, but I love my job! I'm poor, relatively, but it gives me such creative satisfaction, I feel so satisfied doing a really good mix. I know some of the stuff we said earlier probably came across a little jaded and bitter, but we are lucky and we love what we do (Dubbing Mixer 7).

The above statement was made by a senior dubbing mixer in full time employment at the BBC who works on prestigious high-end drama. In recalling his entry into the world of post-production sound, he discussed his Cambridge education, from which he earned a degree in economics, going on to state that, despite this prestigious education, he was drawn to a career in post-production by his interest in music and creativity:

> I saw T-Rex play in Cardiff when I was about ten, and from then on I just knew I wanted to do something musical or creative. Now, I work on big blockbuster dramas, I mean, I mix Dr Who, how cool is that? (Dubbing mixer 7).

This particular dubbing mixer is, of course, the exception rather than the rule. The majority of those interviewed did not enter higher education and do not enjoy the same privileged position with regard to both professional output and job security. However, what is clear from the comments of this dubbing mixer is that he experienced creativity in his work through what Negus describes as the "exclusivist approach". Negus argues that creativity can be experienced through two approaches, with an exclusivist approach characterised by the "human capacity for innovation and originality" and dependent on "inspired" individuals (Negus, 1999, 24). Conversely, an inclusivist creativity can be found in relation to conventional and repetitive tasks, imbuing the individual in "artistic inspiration and humanistic worth." (Negus, 1999, 25).

When assessing the change to professional practice in the era of digital technologies, it is important to assess such notions of 'exclusivist' creativity in the context of the wider industrial framework in which they exist, particularly in light of the issues of changing production hierarchies discussed in the previous chapter. Such self-reflective analysis can, of course, be problematic and distorted by what John Caldwell referred to as "spin" (Caldwell, 2008, 2). Undoubtedly, much of this new creative identity can be put down to spin, in an attempt to retain value in an industry that has laid off over a third of its full-time staff and in which the majority of production staff now suffer reduced income and precarious employment status (Ursell, 2000b; Born, 2004). The value of creativity and professionalism for the construction of craft identities in film and television production is often cited by researchers as a way production staff can fight against the commoditisation of their craft. Caldwell argued that such workers in Los Angeles construct "imagined communities" (Caldwell, 2008, 125-129) in an

effort to generate and communicate cultural value in a churning "nomadic labour system" (Caldwell, 2008, 113-119):

> Employee churn has placed a far higher premium on the ability of craftsworkers to identify themselves as unique, valuable...Explanations of workers' cultural significance can mean the difference between low-ball jobs and more prestige productions (Caldwell, 2008, 114-126).

Vicki Mayer's (2011) research on camera operators in the fledgling US softcore porn industry has shown that camera operators in this particular niche perpetuated an identity as 'professionals'. This allows them to assume a higher status of legitimacy, therefore protecting their labour value from the influx of amateur camera operators as soft core gained some popularity in mainstream US television. Mayer continued, describing how camera operators in this field also perpetuated this identity as a way to give credibility to their jobs in what was seen as a marginalised, even taboo, form of television content. While post-production sound does not suffer from being a particularly marginalised process, with even the most mundane television content usually receiving some level of sound mixing, it does suffer from being the final stage in a linear production process. As Mark Kerins (2011) showed, in his book *Beyond Dolby Stereo*, overruns in production are absorbed by post-production rather than a delayed release. As sound is the last department in this chain and dependent on the picture edits for much of its work, it is often faced with inevitable cuts to time and resources which have been shunted down the line by other departments (Kerins, 2011). While perhaps less pronounced than in the feature film industry, this set of circumstances certainly exists in the television production chain.

This need to cultivate cultural value does not only affect those working in technical roles. Ann Gray (2010) has argued that documentary producers in Britain use terms such as

'instinct' when describing their skills, so as to perpetuate a sense of mystery in an industry where "the creative process is a hugely valuable asset" (Gray, 2010, 64). Furthermore, Caroline Dover (2004), in her work on British documentary producers, has argued that their implications of "documentary craftsmanship" represent an "evocative" defence of their craft against commodification and industry constraints (Dover, 2004, 252). The mass shift in British television towards freelance labour and employment based around casual networks, as well as the affordances of new digital technologies, have undoubtedly had negative implications for those working in post-production sound. As has been shown in Chapter 6, sound is often viewed by producers as an easy target for cost cutting in modern television production. Post-production is not immune to this and has felt the implications in a number of ways. The timeframe available for completing a mix and the resources made available for it are now significantly reduced on all but the most expensive programmes. In an increasingly cost-conscious industry, interviewees consistently cite how working patterns are now more condensed and job roles less defined, as fewer people complete the same amount of work. One dubbing mixer, who works primarily on documentaries and factual entertainment, such as *Springwatch* (2005-Present) and *Antiques Roadshow,* (1979-Present) states:

> Not only have you got to be good but you've got to be fast. It gets to the point where you're sat there in front of your screen with the producer sat behind you saying 'go faster, go faster, I'm paying for this, go faster'. As soon as you walk in the room, the producer is counting the pennies (Dubbing mixer 2).

Another dubbing mixer, again working on short projects, stated:

> Now it's all a one man band. Say I'm doing an episode of Doctors, I've got to do a whole episode in a day, that's track laying and mixing, so there's a lot going on. I work 60 hour weeks, 12 hours a day. By the end of the day I'm tired, my ears are tired and you just can't get the best out of yourself that way (Dubbing Mixer 1).

As another dubbing mixer stated:

> Nowadays, you'll mix for a day, as opposed to [the] 4 days you had on film, and you're gonna track lay for a week instead of [the] three that you would on film and one guy can do both of those processes if he has the skills (Dubbing Mixer 5).

Clearly then, those working post-production sound in British television have experienced significant threats to their profession. As with the great majority of sound roles, and indeed wider production jobs, work is now less secure and harder to acquire. When work is acquired, it now lasts a considerably shorter time and often can comprise as little as a one-day project. In such an environment, there is clearly a need to cultivate value as a means to protect professional status and gain income. However, this need to protect one's craft does not necessarily detract from experiences of creativity in the exclusivist sense. Throughout the interviews, a common theme emerges, relating to job satisfaction and the ability to have a creative impact on a programme soundtrack. One interviewee, now specialising in high-budget documentaries such as *The Life of Birds (1998)* and *Life in Cold Blood* (2008) but who has also

worked on numerous less prestigious programmes such as *Bargain Hunt* (2000-Present), stated:

> What you can do now, the work itself, is so much more sophisticated, and the satisfaction you get out of it is so much greater. The finished product is much more challenging (Dubbing Mixer 6).

Another stressed the enjoyment they get from working primarily on short one-day projects, including dramas such as *Father Brown* (2013-Present) and factual programmes such as car show *Fifth Gear (*2002-2011). Despite their work being less prestigious and requiring fewer resources than the interviewee mentioned above, they nonetheless experienced the same creative satisfaction:

> People don't realise how creative the process is. A lot of people view us as button pushers, but it's incredibly creative. We really put ourselves into the sound design and try to create something unique. I think it's just as creative as say, visual FX or any other job. I can have as much fun with a good reverb and sound effects [as] a picture editor or VFX artist (Dubbing Mixer 1).

Negus has stated that both exclusivist and inclusivist notions of creativity are present in the work of musicians (Negus, 1999), a position on which Caroline Dover built to argue that, despite the rhetoric surrounding creativity being a useful defensive strategy, producers' self-identity as creatives should not be dismissed simply as protectionist self-promotion:

> It would be misleading to dismiss the notion of the programme-maker as creative artist as simply rhetoric. The desire to achieve creativity in its exclusivist sense can and does inflect the practices adopted in fulfilling daily briefs and affects a practitioner's self perception and feelings of satisfaction in his/her work (Dover, 2004, 253).

In light of Negus' and Dover's work, respectively, it would seem unfair to reduce the comments of the dubbing mixers interviewed for this research to mere self-promotion in a cutthroat industry. In line with Katie Quanz's (2015) conclusions on dubbing mixers in the Canadian film industry, this reengineering of their professional identity certainly does fulfil a utilitarian purpose, helping dubbing mixers to perpetuate an image of desirability in what has been shown to be an increasingly inhospitable industry. Sound personnel now face a multitude of obstacles which they must negotiate in order to sustain a financially viable career. Notions of creativity and mystery surrounding their working practices are undoubtedly one of the most effective tools these workers possess when attempting to navigate this new terrain. The desire of many interviewees to identify themselves as belonging to the tribe of digitally-savvy dubbing mixers who have left the "ex RAF types" by the wayside is a clear demonstration of this attempt to cultivate value. However, a desire for exclusivist creativity undoubtedly exists in the digital dubbing era, with many interviewees speaking candidly about their frustrations at the ever-shrinking resources dedicated to sound in post-production. While the financial implications and anxieties that contributed to this frustration were clearly evident and openly discussed, so too were feelings of being artistically limited by these logistical restraints. For these dubbing mixers, great frustration stemmed from being unable to fully impose their creative vision onto a soundtrack, therefore failing to satisfy their professional desires. These desires in themselves are not new, but the ability to effectively achieve them, in a way that is financially and logistically viable, has undoubtedly been made possible by digital technologies. Starting with fader automation in the mid-1970s and continuing today in the form of cheap subscription-based plugins for innumerable different purposes, the affordances of digital technologies have redefined what is possible in post-production sound. Clearly, the

use of these technologies and the concomitant redistribution of skill have had real effects on professional practice and, significantly, are now tied directly to job satisfaction.

The television production industry has changed fundamentally in recent decades. As a result, those working in television sound have had to change accordingly in an effort to adapt to an increasingly hostile environment. However, it is important not to disregard these changes as wholly driven by financial imperative.

Conclusion

This thesis set out to show that the working lives of sound operators have been significantly altered in light of industrial reform and technological change. This statement alone may seem vague, but when broken down into the specific subjects within the previous chapters, there is little doubt that it is an accurate one. In light of the findings of previous chapters, it is undeniable that many aspects of the working lives of sound operators have been fundamentally impacted by the vertical disintegration of broadcasters and the industry wide acceptance of digital technologies.

With regards to training, sound operators now enter the industry through different means and are provided with a radically altered set of skills and knowledge with which they must build their careers. Traditionally, sound operators were trained within vertically integrated broadcasters in which training and the work environment were wholly integrated. Training was tailored uncompromisingly to the needs of television production, and the influence of the BBC culture provided a uniformity and common purpose to the training process. Furthermore, throughout this training, significant attention was given to developing technical skills and an understanding of the engineering principles behind production processes. This training environment shaped the early experiences of sound operators and had a considerable influence over their future careers and professional identities. However, reformed broadcasters have shed themselves of the responsibility to train technical personnel. Meanwhile, higher education in Britain saw rapid expansion, both in number of institutions and remit, and acted to fill the void left by broadcasters. As a result, the majority of sound operators are now trained by universities, rather than by broadcasters. This new training environment lacks many of the characteristics integral to broadcaster training. The uniformity and centralised nature of broadcaster training is absent from the numerous distinct and fragmented institutions that now train sound operators. These institutions lack the coherent and shared ethos, often referred to by interviewees as the ‘grammar of production’, but also offer a significantly different curriculum than that which was offered by the BBC and other broadcasters. The technical grounding that was once fundamental to early training of sound recordists has re-

treated as training has moved to institutions that, traditionally, have favoured theory over vocation and have struggled to negotiate a coherent ethos throughout their own industry wide reform. As has been shown, the shift in training provision has clearly acted to reshape the early experiences of sound operators and influenced the identity and practices of this community throughout their later careers.

Within the new industrial and technological environment, the way sound operators contribute to innovation has also been undeniably changed. As vertically integrated broadcasters have retreated from their role as industry leading research and development centres, sound operators have seen their perceived involvement in innovation significantly decreased. Within the technological framework established by broadcasters, these institutions, particularly the BBC, had the ability to push innovation and industry standard status, both through direct involvement and indirectly as large unit buyers. Throughout this process, the role of operators in field testing and reviewing new equipment held significance for operators, broadcasters, and manufacturers alike. However, as broadcasters have ceased to be large employers of production personnel they have also ceased being large unit buyers of production technologies. As a result, these institutions have lost their significance in negotiating with manufacturers. Both the manufacturers and operators interviewed discussed the difficulties in communicating with one another in the fragmented freelance environment in which operators lack a clear and coherent voice. Furthermore, difficulties in communicating are compounded by operators lacking the technical knowledge needed to make informed and meaningful suggestions regarding digital technologies. As a result, operators now identify themselves as removed from the innovative process and perceive new technologies as being offered by manufacturers on a 'take it or leave it' basis.

In addition to this reduced role in the development of new technologies, sound operators now interact with the technologies of their trade in a fundamentally different way. In the analogue era, 'tinkering' with equipment and managing vast arrays of complex technology was of paramount importance to the work of sound operators. Not only was it the chief concern of operators when at work, the ability to tinker, and the skills required for this, were im-

portant components of their identity within the wider production workforce and tied directly to notions of professionalism. However, digital technologies, no longer based on traditional electromechanical principles, are alien to sound operators skilled in basic electronics and engineering. The introduction of these 'black box' technologies has coincided with the restructuring of training which, as discussed, has seen engineering based skills largely removed from the curriculum of sound operation. As a result, sound operators no longer tinker with their equipment and the ability to maintain and manage these technologies is no longer the yardstick of professionalism it once was. As such, the professional identity of sound operators is far less shaped by such ability. While sound operators undoubtedly still view their work as a skill, or even a talent, it is clear that this area of their work is no longer viewed as central or even necessary at all.

While Chapters 4 -5 have discussed sound operators changing relationships with technology, Chapters 6-7 dealt with the changing relationship of sound operators within the wider communities of television production. As has been shown the relationship shared between sound operators and their production colleagues has been significantly altered over this period. Casual networks of freelancers, whose careers depend on reputation and informal connections, now dominate television production as the industry has moved away from vertically integrated broadcasters. The insecure and fiercely competitive nature of these networks has led to anxiety amongst professional sound operators surrounding issues of job retention and professional reputation. As has been shown, for many, the need to avoid being labelled as 'awkward' when on production, impacts significantly on how sound operators conduct themselves and their practices. The squeezing of pay has further added to this anxiety and has led to an environment where many choose not to voice concerns and opinions lest they be dropped from the informal network which governs future jobs. Beyond job insecurity these new employment arrangements have acted to change in work relationship dynamics in a way that has seen the work of sound operators marginalised within the production hierarchy. The shared grammar of production has been lost as technicians have become fragmented and sound operators often feel that their concerns and opinions are over looked, or even disregarded, by above the line personnel who are primarily concerned with the visual aspect of

production. Furthermore, the loss of any fixed management structure has meant that escalating any grievances is now impossible. Sound operators are now, more than ever, at the command of the above the line personnel present on a production and increasingly feel that their work is misunderstood and unappreciated by those in positions of power.

The reputational nature of employment now means that asserting their views and requirements contains a genuine element of risk, both socially and financially. Yet, yielding suboptimal results, such as inaudible dialogue or a badly balanced mix, once again exposes sound operators to the dangers of reputation based employment. Undoubtedly, for sound operators working in the reformed television industry, negotiating the hierarchy of television production is now significantly more complex, and holds considerably more risk, than in the era of vertical integration.

Sound operators have not been entirely passive throughout this period. As chapter 7 has shown, there has been a considerable shift in the professional identities of sound operators and the value they attribute to the numerous skills they possess. As has been shown, sound operators can no longer lay claim to the extensive technical knowledge possessed by operators in previous decades. Nor do the tools of their profession require the type of highly refined skill that was once required for even basic operation. As such, there has been a significant shift in the professional identity sound operators now cultivate and perpetuate when discussing themselves and their work. Sound operators now view their work as a fundamentally creative endeavour rather than an exercise in technical proficiency. Correspondingly, sound operators now attribute considerable value to their creative qualities and the ability to express these qualities through their working practices. This creative ability, is seen as a characteristic that fundamentally distinguishes current sound operators from those who worked in the era of analogue equipment. Throughout the interview process, those working in the era of analogue technologies were often the targets of ridicule for their inability to master new technologies and the perceived lack of artistic merit in their work. Clearly, such a significant shift in the self-cultivated identity of sound operators must be viewed in light of the many issues discussed throughout this thesis, particularly chapter 6. In an industry that is evermore cost con-

scious and increasingly hostile to their professional practices, it is undeniable that this new professional identity helps sound operators to cultivate an image of value and desirability within the production environment. However, throughout the research process, this new identity, and the significance placed on creativity, was discussed consistently regardless of a given interviewees employment status, career length or the prestige of work conducted. Despite the fairly obvious 'spin' in this newly perpetuated identity, the accounts of interviews present little doubt that this new ability to act creatively has provided a genuine extension of practice as evidenced by the link between job satisfaction and perceived creative freedom. Clearly, sound operators not only conduct their work with different tools but now think about their work in a considerably different way, one that values creativity over technicality.

Throughout this thesis, and the preceding research process, there has been no attempt to frame these changes as either positive or negative. The aim has, of course, been to analyse the accounts and experiences of the interviewees as they present them so as to provide an accurate insight into the community that makes up television sound operators. However, certain issues discussed in this thesis seem to have considerably more dramatic, and arguably negative, impacts than others. An example of a ultimately neutral change can be seen in the shifting role of sound operators in the development of new technologies. While significant to the operators themselves, this shift has not seemingly had any negative impact on the development of new sound equipment. Despite the retreat of broadcasters from development, and the subsequent distancing of operators, manufacturers continue to develop increasingly sophisticated and well received pieces of professional sound equipment. Few, if any, interviewees argued that technologies being produced today were in any way worse than those developed in the era of vertically integrated broadcasters, while many spoke with great enthusiasm of the increased affordances of modern equipment. Therefore, despite holding significance for sound operators, it would clearly be inaccurate to describe these changes as fundamentally negative.

A similar conclusion can be made regarding the changing ways sound operators interact with their professional tools and the disappearance of user 'tinkering' within practice.

Again, this change is undoubtedly of significance to sound operators but, does not impact on an operators' ability to meet the fundamental objective of their work. Despite the prominence of tinkering in day to day practice, for those working in the era of analogue equipment producing good quality sound was always the primary concern. Technical skills were not valuable in isolation but held value when utilised to achieve the overriding objective of operation. The tools with which this objective is achieved are now fundamentally different and, resultantly, the ability to maintain, fix, and tinker with equipment is now largely redundant. However, the goal of sound operators has remained unchanged. Whether this goal was met by utilising technical skills or not is, arguably, not particularly important. Interviewees who worked in the era of analogue equipment still describe current sound operators as skilled or talented professionals. While those who worked exclusively with digital technologies do not view themselves as at a disadvantage by lacking such skill. Clearly, whilst significant to the way operators approach and identify their work, these changes cannot be interpreted as having a directly negative effect on the working lives of sound operators.

While many developments discussed in this thesis could be described as relatively neutral, it seems clear that the issues surrounding production hierarchies have had an altogether more negative impact on sound operators. The accounts of interviewees undoubtedly show that anxiety surrounding work retention is deeply rooted and negatively influences their job satisfaction. Many spoke of their frustration with the perceived lack of respect they are shown at work and the difficulties they have effectively communicating with their production colleagues, particularly those in above the line positions. As has been shown, sound operators now often feel unable to speak up in the pursuit of a good soundtrack. However, interviewees appear acutely aware that not asserting themselves on production exposes them to the risk of poor results, and the damage this can cause to their professional reputation. Successfully negotiating this situation was undoubtedly a source of significant stress and was consistently cited as an aspect of working life with which operators were particularly unhappy, regardless of career length and status. In addition to the anxiety caused by changing production hierarchies, these changes were also repeatedly cited as affecting sound operators financial well-being. Not only is work less secure and more competitive than in previous decades, the wages

offered are increasingly being squeezed by cost conscious production companies. As has been shown, it was a common experience for interviewees to be requested to work at well below their standard rate. Furthermore, interviewees consistently pointed to the issue of stagnant wages and it was often claimed that the standard daily rate had not been increased since the late 1990s. This thesis did not collect enough data to make any definitive claims about income however, it is clear that income is now a significant cause for concern amongst even well - established sound operators[9]. The evidence provided by interviewees suggests it is becoming increasingly difficult to secure a sufficient and sustainable income from professional sound operating.

Many older interviewees stated that, if they were to have embarked on their careers in the current climate, they may well have rethought their career choice. Others stated that, the fierce competition to secure work, and the changing production hierarchy, were contributing factors to their decision to retire early, rather than continue freelancing. Younger interviewees, who lacked the historical context of working for a vertically integrated broadcaster, also spoke of the difficulties of working as a sound operator in the current climate. While passionate about their work, there was a clear sense of disillusionment in their accounts of workplace hierarchies, income, and inherent difficulties of beginning a career in an industry so reliant on reputation. With all this in mind, it is hard not to conclude that shifting work place hierarchies and the increasingly cost conscious nature of television production has had a resoundingly negative effect on the working lives, and well- being, of sound operators.

[9] Data from Creative Skillset (2014) shows that wages within the creative industries were stagnant from 2003-2010 but rose 6% between 2010-2014. Throughout the whole of television, the average annual income was over £38,000, well above the national average. However, Skillset shows that permanent employees earn, on average £11,000 more than freelancers and that there is great disparity among the income of differing professions. In a wider context, the Office for National Statistics (2017b) shows that from from 2000 - 2016 average weekly earnings rose nationally from £313 to £495, a rise 58% throughout this period. Clearly, this data contradicts the situation portrayed by interviewees but is not remotely accurate enough to draw a definitive conclusion.

Areas for future research

This research has provided significant new understanding about the working lives of sound operators in British television. In doing so, it provides numerous avenues for further research. One such opportunity lies in exploring more precisely, the communities of sound operators within ITV franchises. It is a valid criticism of this research, and indeed much of the work on television in Britain, that the BBC has commanded much of the analysis at the expense of ITV franchises. While this is clearly a reflection of the dominance of the BBC within British broadcasting, it illustrates the significant potential for research focussed specifically on the cultures and communities within regional franchises. Undoubtedly, there would be considerable overlap with this research, particularly with regards to issues such as training and standard technologies. Yet, as has been shown, the geographical and industrial context within which communities work has a significant impact on their practices, cultures, and identities. Working within a much smaller, regionally based organisation would have undoubtedly impacted on the work individuals conducted and the way in which they conducted it. As such, the communities of sound operators within ITV franchises undoubtedly deserve further attention and present an interesting opportunity to investigate communities of British sound operators outside the direct influence of the BBC.

Beyond more precise analysis of individual production communities, there is another clear and significant opportunity to build on the findings of this research. An improved understanding of professional practices, as well as the industrial and technological factors that govern them, offers an opportunity to reexamine the aesthetic functions television's soundtrack. Textual analysis of television's soundtrack has lagged considerably behind analysis of the film sound despite the now long established development of television as a stylistically complex medium (Caldwell, 1995; Lotz, 2007; Wheatley 2011). Building on the findings of this research, there lies significant opportunity to conduct textual analysis in a way that has found considerable favour with researchers of film sound. In recent years research that brings together analysis of industry and practice with aesthetic analysis has gained a substantial foothold with scholars of Hollywood film sound. Beck (2003; 2008; 2016) has conducted

considerable work that analyses the aesthetic of 1970s Hollywood sound in light of the industrial reorganisation of the studio system. Addressing the effects of industrial reform specifically on the work of Hollywood sound crews, Beck has explored in detail the resulting influence of new practices on the soundtrack of Hollywood film. Benjamin Wright (2011) has conducted similar work but focussed on the industrial context of modern Hollywood film at a time when digital production methods began to see widespread implementation. Furthermore, Mark Kerins (2011) has brought together industrial and technological analysis with aesthetic analysis in his work on Dolby Digital Surround, again in the context of modern Hollywood film. This methodological approach presents significant potential to progress the research within this thesis and add the existing understanding of televisions sound aesthetic.

As has been discussed within this thesis, the soundtrack of British television has reached unprecedented public awareness in recent years due to do numerous incidents of 'bad' sound. However, as has been shown, analysis of these incidents has been lacking in an understanding of the wider industrial and practical contexts that shape television sound. These events offer a well- timed opportunity to analyse the soundtrack of British television and to do so with a sound knowledge of the industrial, technological, and social context in which it is constructed. This research set out solely to investigate the practices, technologies, and cultures of sound operators when at work and did not intend, or attempt, to provide analysis of the output of this work. As such, there is considerable scope to build on this research, and wider analysis of television's aesthetic, in order to understand how this evolved professional practice, in a reformed production industry, is affecting the soundtrack of British television. Helen Wheatley (2004; 2011) has drawn considerable attention to the "spectacular" nature of modern television's aesthetic, particularly in regards to flagship programmes such as natural history and landscape programming. However, her work often falls short of analysing the soundtrack of such programmes beyond the discussion of the accompanying music. As evidenced by this thesis, music is, of course, only one element of a complex process that incorporates numerous professionals and working practices. In light of the careers, and credits, of the interviewees in this research, the opportunity to build on Wheatley's analysis of natural

history programming, and incorporate analysis of sound more thoroughly, presents an interesting and beneficial starting point from which to advance this research.

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